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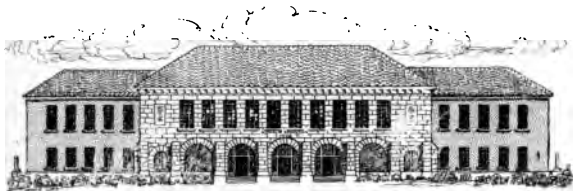
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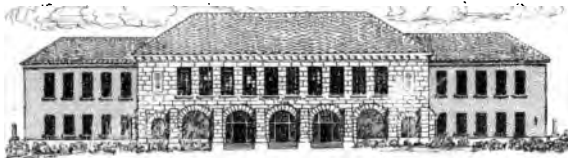


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NEW

INTELLECTUAL ARITHMETIC

DEPARTMENT OF EDUCATION
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ROBINSON'S
NEW ARITHMETICS

Robinson's New Primary Arithmetic
Robinson's New Rudiments of Arithmetic
Robinson's New Intellectual Arithmetic
Robinson's New Practical Arithmetic
Robinson's New Higher Arithmetic

Two-Book Course for Graded Schools

Robinson's New Rudiments of Arithmetic
Robinson's New Practical Arithmetic

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NEW INTELLECTUAL

W. P. 4

PREFACE.

THE importance, and the practical benefit to be derived from the study of Intellectual Arithmetic, not only as a preparation for business life, but as a means of developing and strengthening the thinking and reasoning powers, and of thorough mental culture, cannot be overestimated. Not only is it a necessary study for young pupils, but it is indispensable to the more advanced student, as a preparation for the prompt and accurate business man. And it is believed that, as a general rule, the most critical, correct, and ready students of mathematics are those who have been most thoroughly drilled in Intellectual Arithmetic.

This work is designed for those who have first been well taught in a primary book, and for such as are pursuing the study of written arithmetic or algebra, and who have never been thoroughly exercised in this branch of study.

The aim throughout has been to make the work progressive and comprehensive, to develop clearly all essential principles, and to afford a thorough mental drill

in the application of these to the solution of examples and problems.

The Miscellaneous Problems at the end of the book will furnish a valuable drill for advanced students. These examples require the exercise of considerable thought and reasoning, but the frequent explanations designed as models, and the selection of numbers so adapted to the conditions of the question as to produce results free from difficult combinations, will render a mental solution of them comparatively easy.

Although this edition is a thorough revision, the features which have contributed to the popularity of the Intellectual Arithmetic have been retained. Much important matter has, however, been added, and the subjects have in many cases been more systematically arranged. By a judicious arrangement of matter on the page, it has been possible to include nearly twice as many examples without adding materially to the size of the book.

The book in its present form will commend itself to all by its handsome and clear typography, the logical sequence of the subjects, and its brief, but lucid, illustrations and explanations.

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INTELLECTUAL ARITHMETIC.



ADDITION.

1. Addition is the process of finding a number which is equal to two or more given numbers.

2. The Sum or Amount is the result obtained by the addition.

3. The Sign of Addition is $+$, and is called *plus*. It shows that the numbers connected by it are to be added.

Thus, $3 + 2 + 1$, is read *three plus two plus one*, or *three and two and one*, and shows that 3 and 2 and 1 are to be added.

4. The Sign of Equality is $=$, and is read *equals* or *equal to*. It shows that the numbers connected by it are equal.

Thus, $3 + 2 = 5$, is read *three plus two equals five*, and shows that 5 is the result obtained by adding 3 and 2.

5. Add the following numbers :

- | | | | |
|------------|------------|------------|-------------|
| 1. $1 + 1$ | 2. $1 + 2$ | 4. $1 + 3$ | 7. $1 + 4$ |
| | 3. $2 + 1$ | 5. $2 + 2$ | 8. $2 + 3$ |
| | | 6. $3 + 1$ | 9. $3 + 2$ |
| | | | 10. $4 + 1$ |

11. Name the numbers whose sum is 2; 3; 4; 5.

12. $1 + 5$	21. $5 + 2$	30. $1 + 8$	39. $2 + 8$
13. $2 + 4$	22. $6 + 1$	31. $2 + 7$	40. $3 + 7$
14. $3 + 3$	23. $1 + 7$	32. $3 + 6$	41. $4 + 6$
15. $4 + 2$	24. $2 + 6$	33. $4 + 5$	42. $5 + 5$
16. $5 + 1$	25. $3 + 5$	34. $5 + 4$	43. $6 + 4$
17. $1 + 6$	26. $4 + 4$	35. $6 + 3$	44. $7 + 3$
18. $2 + 5$	27. $5 + 3$	36. $7 + 2$	45. $8 + 2$
19. $3 + 4$	28. $6 + 2$	37. $8 + 1$	46. $9 + 1$
20. $4 + 3$	29. $7 + 1$	38. $1 + 9$	47. $1 + 10$

Add the following numbers:

49. $6 + 5$	54. $7 + 5$	59. $9 + 4$	64. $9 + 6$
50. $7 + 4$	55. $8 + 4$	60. $7 + 7$	65. $8 + 8$
51. $8 + 3$	56. $9 + 3$	61. $8 + 6$	66. $9 + 7$
52. $9 + 2$	57. $7 + 6$	62. $9 + 5$	67. $9 + 8$
53. $6 + 6$	58. $8 + 5$	63. $8 + 7$	68. $9 + 9$

Examples 49–68 may also be written in columns as follows. Add each column:

[illegible]

89. Begin with 2 and count by 2's to 50.

Thus, 2, 4, 6, 8, etc.

90. Begin with 3 and count by 2's to 51.

Thus, 3, 5, 7, 9, etc.

91. Begin with 4 and count by 2's to 100.

92. Begin with 6 and count by 2's to 80.

93. Begin with 7 and count by 2's to 99.

94. Begin with 8 and count by 2's to 100.

95. Begin with 10 and count by 2's to 90.

96. Count alternately by 2's and 3's to 35.

Thus, 2, 5, 7, 10, 12, 15, etc.

97. Count by 3's and 4's to 32.

98. Count by 2's and 4's to 36.

99. Count by 2's and 5's to 35.

100. Count by 3's and 5's to 32.

Find the sums :

101. $4 + 3$ 105. $7 + 2$ 109. $8 + 6$ 113. $3 + 3$

102. $5 + 8$ 106. $9 + 8$ 110. $9 + 6$ 114. $8 + 8$

103. $8 + 7$ 107. $4 + 4$ 111. $5 + 5$ 115. $7 + 9$

104. $6 + 3$ 108. $6 + 4$ 112. $9 + 4$ 116. $3 + 5$

117. Add 2 to each of the following numbers :

8 9 6 5 7 3 2 4 1

118. To the same numbers add 3; 6; 5; 7; 8; 4; 6; 9.

119. Begin with 4 and count by 4's to 100.

120. Begin with 5 and count by 5's to 200.

121. Count by 6's to 96, beginning with 6.

122. Count by 7's to 98, beginning with 7.

Name the sums of the following:

Add the following numbers:

[illegible]

186.	187.	188.	189.	190.	191.	192.	193.	194.
3	23	33	43	53	63	73	83	93
<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>
195.	196.	197.	198.	199.	200.	201.	202.	203.
4	24	34	44	54	64	74	84	94
<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
204.	205.	206.	207.	208.	209.	210.	211.	212.
25	29	36	49	56	34	32	14	13
<u>3</u>	<u>2</u>	<u>4</u>	<u>5</u>	<u>14</u>	<u>15</u>	<u>12</u>	<u>25</u>	<u>35</u>
213.	214.	215.	216.	217.	218.	219.	220.	221.
56	39	14	74	91	69	54	85	15
<u>22</u>	<u>15</u>	<u>45</u>	<u>38</u>	<u>18</u>	<u>17</u>	<u>28</u>	<u>36</u>	<u>63</u>

Add:

222. $3 + 2 + 1$	232. $8 + 6 + 1$	242. $3 + 4 + 9$
223. $4 + 3 + 2$	233. $3 + 3 + 3$	243. $9 + 7 + 2$
224. $3 + 1 + 5$	234. $3 + 4 + 5$	244. $4 + 7 + 8$
225. $8 + 8 + 2$	235. $4 + 6 + 6$	245. $4 + 4 + 4$
226. $2 + 8 + 9$	236. $5 + 5 + 7$	246. $9 + 8 + 7$
227. $1 + 7 + 9$	237. $1 + 5 + 7$	247. $2 + 5 + 8$
228. $1 + 4 + 5$	238. $2 + 4 + 8$	248. $4 + 6 + 7$
229. $6 + 6 + 6$	239. $2 + 6 + 7$	249. $6 + 8 + 9$
230. $3 + 3 + 6$	240. $1 + 9 + 3$	250. $8 + 8 + 8$
231. $8 + 8 + 2$	241. $6 + 4 + 9$	251. $9 + 9 + 9$

Find the amounts:

252. $6 + 2 + 1 + 4$	256. $5 + 4 + 3 + 1$
253. $3 + 2 + 5 + 4$	257. $7 + 1 + 2 + 1$
254. $2 + 4 + 5 + 1$	258. $4 + 3 + 3 + 3$
255. $6 + 1 + 2 + 2$	259. $3 + 3 + 3 + 3$

260.	$4 + 4 + 4 + 4$	270.	$5 + 3 + 3 + 5 + 3$
261.	$5 + 5 + 5 + 5$	271.	$6 + 7 + 9 + 8 + 2$
262.	$8 + 7 + 3 + 2$	272.	$7 + 1 + 7 + 2 + 3$
263.	$9 + 8 + 2 + 4$	273.	$9 + 4 + 3 + 2 + 1$
264.	$8 + 3 + 9 + 6$	274.	$8 + 3 + 2 + 1 + 5$
265.	$6 + 5 + 7 + 8$	275.	$7 + 5 + 6 + 1 + 8$
266.	$6 + 6 + 8 + 2$	276.	$9 + 1 + 3 + 2 + 9$
267.	$8 + 8 + 8 + 1$	277.	$7 + 7 + 6 + 5 + 4$
268.	$7 + 6 + 7 + 6$	278.	$5 + 6 + 7 + 8 + 9$
269.	$3 + 4 + 2 + 9$	279.	$3 + 4 + 5 + 6 + 7$

Give the sum of each of the following columns:

280.	281.	282.	283.	284.	285.	286.	287.
5	2	7	9	6	4	8	5
3	4	4	2	5	1	3	6
2	3	5	5	3	9	1	7
4	6	2	4	8	7	2	8
7	2	1	3	4	2	4	9

Add each of the following columns separately; then add each row of numbers from left to right:

288.	289.	290.	291.	292.	293.	294.	295.
1	2	3	4	6	9	5	9
2	2	3	4	6	1	1	8
3	8	7	6	4	5	4	5
4	8	7	6	4	5	2	5
5	4	2	8	8	6	3	3
7	6	9	2	2	7	5	4
8	6	8	9	2	3	1	6
9	6	8	9	2	2	2	4

ADDITION.

13

296.	297.	298.	299.	300.	301.	302.
23	42	39	91	65	22	77
42	65	35	43	83	44	99
54	71	84	21	92	55	33
65	82	72	30	41	66	44
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
303.	304.	305.	306.	307.	308.	309.
333	421	444	777	555	818	897
333	154	444	123	555	999	654
321	678	567	555	443	765	969
345	314	321	654	698	213	578
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

310. Let some pupil, begin with the right-hand column and say, "0, 17, 24, 27, 33, 42 *units*, equal to 4 tens and 2 units; add the 4 tens to the next column." The next pupil will without any delay take up the process, beginning with the 4 tens reserved, and say, "4, 12, 14, 18, 23, 26, 34 *tens*, equal to 3 hundreds and 4 tens; add the 3 hundreds to the next column." So in quick succession let each column be added upwards, then downwards; then the lines from right to left, and from left to right, until the whole class has been exercised upon the example.

Add the following columns :

311.	312.	313.	314.	315.
2046	4250	32607	84065	920684
3678	8786	78982	37987	216677
2766	5968	69771	66789	569911
8345	8789	68339	44321	543344
3875	9896	56234	91389	576677
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

316.	317.	318.	319.	320.
32507	23412	35092	275143	121418
10325	57638	52803	413100	274236
47018	15421	47524	650406	127514
53106	62732	60832	210350	202056
61007	54298	11462	123415	160391
27589	17323	74260	113765	184608
321.	322.	323.	324.	325.
68046	13222	74564	217345	780002
46258	12313	27892	166459	956010
86048	31359	83571	225224	103408
25137	22441	13456	306892	522222
47346	14321	35683	102555	888888
99008	22720	30907	214653	123456
326.	327.	328.	329.	330.
82015	12364	87523	763447	347802
50720	48070	76258	903248	987000
41875	67346	71229	832109	703218
25638	20371	53439	602976	639947
15136	16070	85614	573843	927632
42893	46137	90241	890050	802263
331.	332.	333.	334.	335.
83591	24000	52498	1934	987654
4720	6048	75	621	567893
389	32199	199	87002	75430
62121	654	3000	519	38078
54	7290	5249	68	205020
8	65004	600	745	780902

A great variety of examples may be made from the following *Ledger Columns* by adding the numbers in the *first line* of the *four* columns, then, in the *second line*, etc., until all have been used in the same manner.

Then add *four* numbers in the *first* column, then *five* numbers, then *six*, and so on up to *ten* numbers. Do the same with all the columns.

336.	337.	338.	339.
\$ 42.17	\$ 506.76	\$ 2371.67	\$ 14763.84
36.24	194.32	4571.84	33276.90
18.42	427.90	1690.50	47061.39
10.71	173.26	2037.69	18242.76
194.30	71.32	5094.46	37364.96
347.16	39.46	876.54	8410.31
40.00	152.60	679.81	5724.27
12.94	271.78	155.48	56317.66
86.73	320.00	4930.71	81742.73
271.19	709.08	3104.13	22431.27
103.07	48.50	1987.67	40163.55
500.50	63.41	5142.84	32189.60
7.59	56.00	276.30	7063.21
11.44	410.10	522.71	3451.09
81.92	372.22	3114.60	9200.00
110.10	137.89	1776.82	1807.36
107.09	276.44	7152.91	56768.72
207.16	18.19	9328.42	63024.27
97.20	27.96	472.19	36180.45
21.77	157.16	321.42	90807.08
150.15	94.57	2423.79	28763.81
427.26	177.66	1600.81	37196.75
316.42	327.40	5976.27	4230.61

PROBLEMS.

6. 1. I had 1 pansy and I picked 1 more. How many pansies had I then?

2. If a lead pencil costs 2 cents, and a slate pencil 1 cent, how many cents will both cost?

3. Emma spent 2 cents for candy, and had 2 cents left. How many cents had she at first?

4. A farmer had 3 cows in one field, and 2 in another. How many cows were there in both fields?

5. John had 2 marbles in one pocket and 3 in another. How many marbles had he altogether?

6. Frank gave John 3 apples, and then had 4 left. How many apples had he at first?

7. There are 4 books on one desk, and 2 books on another. How many books are there on both desks?

8. If a lemon costs 3 cents, and an orange 5 cents, how many cents do both cost?

9. In a certain class there are 5 girls and 4 boys. How many pupils are there in the class?

10. There were 3 roses on one bush, and 3 on another. How many roses were there on both bushes?

11. If a barrel of apples costs 2 dollars, and a cord of wood 4 dollars, how many dollars do both cost?

The sign \$ may be used for dollars; thus, \$ 4 for 4 dollars.

12. A man bought a calf for \$ 7, and sold it for \$ 3 more than he paid for it. For how much did he sell it?

13. In a grocery store there were 2 barrels of green apples and 8 barrels of red apples. How many barrels of apples were there altogether?

14. If a coat costs \$ 10, and a hat \$ 5, what will be the cost of both?

15. There were 4 books on one shelf, and 7 books on another. How many books were there on both shelves?

16. A farmer sold 5 sheep to one man, and 9 to another. How many sheep did he sell to both?

17. Ralph walked 4 miles and rode 10 miles. How many miles did he go?

18. Philip answered 8 questions in geography, and Henry 5. How many questions did both answer?

19. In an orchard there were 10 apple trees and 4 pear trees. How many trees were there in the orchard?

20. Fred paid \$ 9 for a suit of clothes, and \$ 6 for an overcoat. How much did he pay for both?

21. One fisherman caught 7 fish, and his companion caught 9. How many fish did both catch?

22. A milkman sold a customer 8 quarts of milk one day, and 6 quarts the next. How many quarts did he sell him in the two days?

23. Mary is 10 years old. How old will she be 5 years from this time?

24. A lady paid \$ 7 for a shawl, and \$ 6 for a dress. What was the cost of both?

25. There are 9 boys in one class, and 7 in another. How many boys are there in both classes?

26. Margaret has 8 flower pots in one room, and 5 in another. How many has she in the two rooms?

27. If you read 10 pages to-day, and 7 pages to-morrow, how many pages will you read in both days?

28. A farmer had 9 white cows and 8 black ones. How many cows had he?

29. John has 6 young rabbits and 4 old ones. How many rabbits has he?

30. There are 10 birds sitting in one tree, and 9 in another. How many birds are there in both trees?

31. A boy, having some peaches given him, put 8 into his hat, and 7 into his pockets. How many peaches were given him?

32. Edwin sold 6 newspapers in one car, and 8 in another. How many newspapers did he sell in both cars?

33. In one house there are 5 windows, and in another 7. How many windows are there in both houses?

34. If you work 8 examples in arithmetic to-day, and 8 more to-morrow, how many will you work in both days?

35. Robert gave his brother 8 marbles, and had 9 left. How many marbles had he at first?

36. A man paid \$12 for corn, \$8 for hay, and \$6 for flour. How much did he pay for all?

SOLUTION. — He paid $\$12 + \$8 + \$6$, which is \$26.

37. There were 12 roses on one bush, 10 on another, and 6 on a third. How many roses were there on the three bushes?

38. A drover had 15 horses in one pasture, 13 in another, and 9 in another. How many horses had he altogether?

39. James has 10 cents, Henry has 7, and John has 5. How many cents have the three boys?

40. In one street there are 14 brown stone houses, 12 brick houses, and 9 frame houses. How many houses are there on that street?

41. In a workshop there are 7 men, 9 boys, and 6 girls at work. How many people are at work in the shop?

42. A farmer's wife churned 10 pounds of butter at one time, 12 pounds at another, and 8 pounds at another. How many pounds did she churn in all?

43. William bought a copy book for 15 cents, a quire of paper for 12 cents, and a bottle of ink for 6 cents. What was the cost of all?

44. There were 10 spools of thread in one drawer, 11 in another, and 13 in a third. How many spools were there altogether?

45. In a certain class there are 18 girls and 24 boys. How many pupils are there in the class?

46. A man bought a sleigh for \$ 20 ; he paid \$ 10 for repairing it, and \$ 6 for painting it. How much did it cost him altogether?

47. Charles earned 25 cents one day, and 32 the next. How much did he earn in both days?

48. I bought at the dairy a pound of butter for 30 cents, eggs for 25 cents, and a quart of milk for 6 cents. How much did I pay for them all?

49. In a certain barnyard there were 11 roosters, 22 hens, and 7 turkeys. How many fowls were there in the barnyard?

50. A traveler walked 30 miles one day, 26 miles the next day, and 21 miles the third day. How many miles did he travel in the three days?

51. Mary solved 15 examples on Monday, 16 on Tuesday, and 18 on Wednesday. How many did she solve in the three days?

52. A man paid \$ 60 for a horse, \$ 23 for a saddle, and \$ 9 for a bridle. How much did he pay for the horse, saddle, and bridle?

53. There were 36 leaves on one branch, 34 on another, and 27 on a third. How many leaves were there on the three branches?

54. A man bought a piece of land for \$ 76 and paid \$ 25 for fencing it. For how much must he sell it to gain \$ 15?

55. A boy gathered 12 shells one day, 15 the second day, 11 the third day, and 16 the fourth day. How many shells had he at the end of the fourth day?

56. A grocer bought some potatoes for \$ 20, some oats for \$ 19, some oranges for \$ 16, and some apples for \$ 10. How much did he pay for all?

57. A miller shipped by railroad 28 barrels of flour at one time, 37 at another, and 40 at another. How many barrels of flour did he ship altogether?

58. If Fred paid 45 cents for a penknife, 15 cents for some paper, 12 cents for a blank book, and 7 cents for a penholder, how much money did he spend?

59. A drover bought 26 sheep of one man, 30 of another, 37 of another, and 40 of another. How many sheep did he purchase?

60. I bought a horse for \$75 and I wish to sell it so as to gain \$25. How much must I receive for it?

61. In a certain orchard there were 22 apple trees, 16 pear trees, 14 cherry trees, and 7 peach trees. How many fruit trees were there altogether?

62. Edwin bought a knife for 35 cents; he exchanged the knife and 12 cents for a book, which he afterwards sold for 10 cents more than it cost him. How much did he receive for the book?

63. In a certain factory there are 31 men, 27 boys, and 19 girls at work. How many people are at work in the factory?

64. A farmer raised 54 bushels of wheat, 66 bushels of oats, and 40 bushels of corn. How many bushels of grain did he raise?

65. If the belfry of a church is 62 feet from the ground, and the top of the steeple 76 feet from the belfry, how far from the ground is the top of the steeple?

66. In March there are 31 days; in April, 30; in May, 31. How many days are there in those three months?

67. January has 31 days; February, 28; June, 30. How many days are there in those three months? How many days are there in the first three months of the year? In the first six months?

68. July has 31 days; August, 31; September, 30; October, 31; November, 30. How many days are there in the second half of the year?

69. If a farm contains 83 acres of cleared land and 25 acres of woodland, how many acres are there in the whole farm?

70. A mother is 37 years older than her son, who is 31 years old. How old is the mother?

71. A tailor bought three pieces of cloth, the first containing 29 yards, the second 26 yards, and the third 25 yards. How many yards did the three pieces contain?

72. A furniture dealer sold a library desk for \$15, and a cabinet for \$48. How much did he receive for both?

73. A soldier who entered the army at the age of 33 years served for 25 years. What was his age when he left the army?

74. A farmer received \$29 for some pork, \$18 for some hay, \$15 for some oats, and \$12 for wood. How many dollars did he receive for his sales?

75. Thomas hoed 13 rows of corn, Harry 16 rows, David 14 rows, and John 10 rows. How many rows did they all hoe?

76. A man paid \$30 for a coat, \$7 for a vest, \$11 for a pair of trousers, and \$5 for a hat. What was the cost of all?

77. I had a carriage worth \$60 which I exchanged for a horse by paying \$25 in addition. When the horse had cost me \$12 for keeping, I sold it for \$20 more than it cost me. For how much did I sell it?

78. A man deposited \$40 in a bank, which was \$15 less than his neighbor deposited at the same time. How much did both deposit?

SUBTRACTION.

7. Subtraction is the process of taking away part of a number or of finding the difference between two numbers.

8. The Minuend is the number from which another is to be taken.

9. The Subtrahend is the number to be taken from the minuend.

10. The Remainder or Difference is the number remaining after one has been taken from the other.

11. The Sign of Subtraction is $-$, and is called *minus*, which signifies *less*. When placed between two numbers, it indicates that the number following it is to be taken from the one preceding it.

Thus, $6 - 4 = 2$ is read, 6 *minus* 4 *equals* 2, or 6 *less* 4 *is* 2, and shows that 4, the *subtrahend*, taken from 6, the *minuend*, equals 2, the *remainder*, or that the *difference* between 6 and 4 is 2.

12. Find the remainders:

- | | | | |
|------------|--------------|--------------|--------------|
| 1. $4 - 2$ | 7. $5 - 2$ | 13. $10 - 6$ | 19. $20 - 6$ |
| 2. $3 - 2$ | 8. $2 - 2$ | 14. $7 - 5$ | 20. $23 - 9$ |
| 3. $6 - 2$ | 9. $5 - 3$ | 15. $14 - 8$ | 21. $18 - 4$ |
| 4. $7 - 2$ | 10. $7 - 4$ | 16. $12 - 7$ | 22. $14 - 4$ |
| 5. $8 - 2$ | 11. $11 - 2$ | 17. $9 - 8$ | 23. $17 - 3$ |
| 6. $9 - 2$ | 12. $6 - 4$ | 18. $15 - 9$ | 24. $16 - 2$ |

Find the difference between :

25. 16 and 7	30. 25 and 35	35. 20 and 9
26. 20 and 8	31. 22 and 11	36. 17 and 6
27. 15 and 6	32. 33 and 42	37. 18 and 5
28. 5 and 9	33. 25 and 16	38. 17 and 3
29. 19 and 3	34. 12 and 32	39. 20 and 4

	40.	41.	42.	43.	44.	45.	46.	47.	48.
From	10	11	12	13	15	19	23	27	35
Take	<u>5</u>	<u>6</u>	<u>8</u>	<u>7</u>	<u>9</u>	<u>3</u>	<u>4</u>	<u>2</u>	<u>8</u>

	49.	50.	51.	52.	53.	54.	55.	56.	57.
From	18	17	16	14	27	39	45	54	60
Take	<u>8</u>	<u>6</u>	<u>5</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>2</u>	<u>3</u>	<u>6</u>

Find the remainders :

	58.	59.	60.	61.	62.	63.	64.
Minuend	134	429	631	759	452	849	687
Subtrahend	<u>112</u>	<u>208</u>	<u>520</u>	<u>647</u>	<u>231</u>	<u>631</u>	<u>576</u>

In each of the following examples, how much must be taken from the first number to make the second?

	1st.	2d.		1st.	2d.		1st.	2d.		1st.	2d.		1st.	2d.
65.	8	4	69.	19	11	73.	29	13	77.	62	40			
66.	9	5	70.	13	4	74.	35	15	78.	51	31			
67.	7	3	71.	14	9	75.	39	14	79.	34	29			
68.	12	7	72.	15	6	76.	41	13	80.	73	24			

In each of the following examples, how much must be added to the first number to make the second?

	1st.	2d.		1st.	2d.		1st.	2d.		1st.	2d.
81.	9	18	85.	11	16	89.	21	43	93.	74	84
82.	6	17	86.	14	21	90.	54	62	94.	55	95
83.	10	15	87.	13	24	91.	59	64	95.	67	87
84.	9	19	88.	19	25	92.	65	69	96.	26	56

97. Count backwards by 7's from 49 to 0. From 46 to 4. From 43 to 1.

98. Count backwards by 8's from 48 to 0. From 47 to 7. From 42 to 2.

99. Count backwards by 9's from 45 to 0. From 41 to 5.

Count backwards from 100 by:

100.	2's	102.	4's	104.	6's	106.	8's	108.	10's
101.	3's	103.	5's	105.	7's	107.	9's	109.	11's

	110.	111.	112.	113.	114.
From	3256	4791	8923	4912	6315
Take	<u>2143</u>	<u>2551</u>	<u>7612</u>	<u>2300</u>	<u>4204</u>

	115.	116.	117.	118.	119.
From	9876	5342	6798	5476	3989
Take	<u>7654</u>	<u>3000</u>	<u>1010</u>	<u>4444</u>	<u>3333</u>

	120.	121.	122.	123.	124.
From	9856	3472	6583	8431	7624
Take	<u>7643</u>	<u>2260</u>	<u>2483</u>	<u>2330</u>	<u>6524</u>

Find the results:

- | | | |
|------------------|------------------|------------------|
| 125. $4 + 7 - 3$ | 130. $8 - 3 + 2$ | 135. $8 + 7 - 1$ |
| 126. $5 + 8 - 2$ | 131. $8 + 2 - 3$ | 136. $9 - 2 + 7$ |
| 127. $6 + 7 - 5$ | 132. $7 + 3 - 6$ | 137. $6 + 3 - 2$ |
| 128. $5 - 3 + 4$ | 133. $8 - 6 + 3$ | 138. $8 - 6 + 1$ |
| 129. $9 + 4 - 2$ | 134. $9 + 5 - 2$ | 139. $9 - 5 + 5$ |

Perform the addition and subtraction, as indicated:

- | | |
|--------------------------|--------------------------|
| 140. $4 + 7 + 9 - 8$ | 146. $19 - 12 + 25 - 25$ |
| 141. $9 + 12 + 6 - 7$ | 147. $26 + 15 + 7 - 18$ |
| 142. $14 + 10 + 12 - 24$ | 148. $40 + 10 + 8 - 20$ |
| 143. $20 + 16 + 5 - 14$ | 149. $30 + 9 + 7 - 15$ |
| 144. $44 + 20 + 10 - 50$ | 150. $40 - 5 + 6 - 16$ |
| 145. $27 + 15 + 12 - 30$ | 151. $39 - 3 + 5 - 12$ |

How much less than

- | | |
|--------------------------|-------------------------|
| 152. 64, is $25 + 20$? | 158. 49, is $36 + 11$? |
| 153. 56, is $28 + 16$? | 159. 65, is $36 + 10$? |
| 154. 100, is $46 + 34$? | 160. 34, is $30 - 15$? |
| 155. 50, is $25 + 25$? | 161. 45, is $19 - 14$? |
| 156. 45, is $15 + 11$? | 162. 28, is $24 - 17$? |
| 157. 36, is $20 + 15$? | 163. 60, is $50 - 30$? |

How much more than

- | | |
|------------------------|------------------------|
| 164. 15, is $10 + 6$? | 170. 45, is $50 - 3$? |
| 165. 17, is $20 + 5$? | 171. 49, is $60 - 4$? |
| 166. 9, is $30 + 6$? | 172. 20 - 10, is 30? |
| 167. 18, is $55 + 9$? | 173. 55 - 20, is 40? |
| 168. 10, is $50 - 8$? | 174. 58 - 25, is 46? |
| 169. 30, is $40 - 5$? | 175. 95 - 40, is 60? |

	176.	177.	178	179.	180.
From	473	719	645	456	394
Take	<u>156</u>	<u>645</u>	<u>261</u>	<u>192</u>	<u>275</u>
	181.	182.	183.	184.	185.
From	645	387	963	630	457
Take	<u>564</u>	<u>348</u>	<u>406</u>	<u>206</u>	<u>278</u>
	186.	187.	188.	189.	
From	5274	7345	9876	2925	
Take	<u>1548</u>	<u>5456</u>	<u>4894</u>	<u>1673</u>	
	190.	191.	192.	193.	
From	3246	4713	2704	8463	
Take	<u>1328</u>	<u>2430</u>	<u>1524</u>	<u>5372</u>	
	194.	195.	196.	197.	
From	5672	1704	4030	3500	
Take	<u>3834</u>	<u>845</u>	<u>3120</u>	<u>2500</u>	
	198.	199.	200.	201.	
From	546	438	637	764	
Take	<u>234</u>	<u>321</u>	<u>431</u>	<u>423</u>	
	202.	203.	204.	205.	
From	2467	4825	6041	7234	
Take	<u>1024</u>	<u>2103</u>	<u>3011</u>	<u>5012</u>	
	206.	207.	208.	209.	
From	3982	7654	8420	5217	
Take	<u>290</u>	<u>3050</u>	<u>6701</u>	<u>25</u>	

Name the sums and the differences:

210.	211.	212.	213.	214.
50	500	5000	70	700
<u>20</u>	<u>200</u>	<u>2000</u>	<u>50</u>	<u>500</u>
215.	216.	217.	218.	219.
80	600	8000	800	5000
<u>40</u>	<u>100</u>	<u>2000</u>	<u>300</u>	<u>2000</u>
220.	221.	222.	223.	224.
20	400	4000	606	4040
<u>8</u>	<u>120</u>	<u>1500</u>	<u>303</u>	<u>2020</u>
225.	226.	227.	228.	229.
809	507	6008	908	9008
<u>504</u>	<u>304</u>	<u>3002</u>	<u>507</u>	<u>5007</u>

PROBLEMS.

13. 1. James, who had 5 picture books, gave 2 to his sister. How many had he left?

SOLUTION.—5 books — 2 books = 3 books. He had 3 books left.

2. Mary is 5 years old and her sister is 2. What is the difference in their ages?

3. Ella had 6 cents and spent 2 cents. How much had she left?

4. On a rosebush there were 7 roses, and Emma picked 3 of them. How many were left?

5. I picked 5 bananas off a bunch containing 10. How many were left?

6. A boy had 7 marbles, and lost 4 of them. How many had he left?

7. If there are 8 pigs in a pen, and 5 of them get out, how many remain?

8. An errand boy had 12 parcels. After delivering 7 of them, how many parcels had he left?

9. Margaret is 11 years old, and Julia is 4 years younger. What is Julia's age?

10. A man walked 9 miles one day and 3 miles less the next. How many miles did he walk the second day?

11. A man, earning \$10 a week, spends \$6 for provisions. How many dollars has he left?

12. James borrowed \$12, and paid \$7 of it. How much of the debt remained unpaid?

13. If you have 12 turkeys, and sell 9 of them, how many will you have left?

14. A boy bought 25 railroad tickets, and used 8 of them in one week. How many tickets had he left?

15. A newsboy sold 20 papers in the morning, and 8 less than that in the evening. How many papers did he sell in the evening?

16. From a cistern holding 36 barrels of water, 12 barrels leaked out. How many barrels remained?

17. A man, having \$25 due him, received some hay worth \$11, and the remainder of the debt in money. How much money did he receive?

18. There are 46 trees in an orchard; 35 of them are apple trees and the remainder are peach trees. How many peach trees are there?

19. John read 33 pages of his book in the morning, and 15 less than that in the afternoon. How many pages did he read in the afternoon?

20. A jeweler bought a watch for \$60, and sold it for \$75. How much did he gain?

21. The number of pupils on register in a school is 87, and 65 are in attendance. How many are absent?

22. A farmer lives 48 miles away from the nearest mill. If he travels 16 miles one day, how many miles farther must he go to reach the mill ?

23. There are 36 wild ducks in a flock, and a huntsman kills 13 of them. How many ducks are left ?

24. A farmer sold a cow that cost him \$30 for \$22. How much did he lose by the sale ?

25. A grocer bought a quantity of sugar for \$39, and sold it for \$50. How much did he gain ?

26. There are 35 milestones on the road between two towns. After reaching the 28th milestone how many more must I pass in making the journey from one town to the other ?

27. In a park there were 49 oak trees and 60 maple trees. How many more maples were there than oaks ?

28. On a warm day the thermometer indicated 85 degrees. How many degrees was that above the freezing point, which is 32 degrees ?

29. A man died at the age of 77 years, having been married 49 years. What was his age when he married ?

30. A man, having \$30, paid \$15 for a coat, \$5 for a vest, and \$4 for a hat. How much had he left ?

SOLUTION. — He paid $\$15 + \$5 + \$4$, which is $\$24$; $\$30 - \$24 = \$6$. He had \$6 left.

31. A little girl had 16 seams to sew. She sewed 6 one day, and 4 the next. How many were there left to sew ?

32. In a certain ward there were 39 stores, of which 15 were groceries and 8 bakeries. How many other stores were there in the ward ?

33. A boy had 45 copies in his writing book. He wrote 15 one week and 17 the next. How many copies had he left to write ?

34. A boy found 8 apples under one tree, 10 under another, and 6 under another; he ate 3, gave away 7, and carried the remainder home. How many did he take home?

35. If I buy a coat for \$ 8 and a dress for \$ 5, and give in payment a \$ 20 bill, how much change should I receive?

36. Charles had 16 cents on Monday. He earned 10 cents on Tuesday and 9 cents on Wednesday, and his father then gave him enough more to make the sum 50 cents. How much money did he receive from his father?

37. A merchant bought a quantity of sugar for \$ 50; he paid \$ 6 for freight and customs, and sold the sugar for \$ 75. How much did he gain?

38. A man bought a watch for \$ 40, a chain for \$ 15, and a pin for \$ 3, and he sold them all for \$ 50. How much did he lose by the transaction?

39. Sarah had 50 cents; she bought a comb for 12 cents, some ribbon for 16 cents, a thimble for 10 cents, and some thread for 6 cents. How much money had she left?

40. In a collection of 57 pictures, 9 were photographs, 13 etchings, and the rest water colors. How many water colors were there?

41. A boy started with 26 packages of matches to sell. He sold 9 packages in the morning and 10 in the afternoon. How many packages had he left?

42. In a certain book there were 89 pages. Henry read 20 pages one day, 13 the next, and 9 the third day. How many pages had he still to read?

43. Four men bought a horse for \$ 80; the first paid \$ 25, the second \$ 20, and the third \$ 18. How much did the fourth pay?

44. In a box containing 48 buttons, 12 were bone, 18 china, and the rest pearl. How many pearl buttons were there in the box?

45. A man traveled 22 miles one day, and 26 miles the second day, and on the third day he traveled back 30 miles. How many miles was he from the place from which he first started?

46. In a plot of 75 acres, a farmer planted 20 acres with corn, 37 acres with potatoes, and the remainder with oats. How many acres of oats were there?

47. A man owed his grocer \$18, his tailor \$20, and a merchant \$25; he paid the grocer \$10, the tailor \$12, and the merchant \$15. How much did he still owe them all?

48. I bought a horse for \$90, a cutter for \$40, and a harness for \$20, and then sold them all for \$50 more than the horse cost me. Did I gain or lose by the transaction, and how much?

49. A lady bought a new bonnet for \$7, a dress for \$12, a pair of shoes for \$4, and a parasol for \$3; she gave the merchant three \$10 bills. How many dollars did she receive in return?

50. On a certain bush there were 31 roses, 13 of them were picked and 11 were blown off in a storm. How many roses were left on the bush?

51. A farmer had 45 sheep in one lot, 37 in another, and 30 in another; from the first lot he sold 20 sheep, from the second 15, and from the third 12. How many sheep had he altogether at first, and how many had he left after the sale?

52. A grocer started for market with seven \$10 bills and six \$5 bills in his pocket. When he returned he had six \$10 bills and three \$5 bills left, and \$2 in change. How much money had he spent?

MULTIPLICATION.

14. Multiplication is the process of taking one of two given numbers as many times as there are units in the other.

15. The Multiplicand is the number to be multiplied.

16. The Multiplier is the number by which to multiply, and shows how many times the multiplicand is to be taken.

17. The Product is the result obtained by the process of multiplication.

18. The Factors of a product are the multiplicand and multiplier.

19. The Sign of Multiplication is \times and is read *multiplied by* or *times*. When placed between two numbers it shows that one is to be multiplied by the other.

Thus, 3×4 is read 3 *times* 4, or 3 *multiplied by* 4 (or 3 *by* 4), or 4 *multiplied by* 3.

20. Give the products :

- | | | | |
|-----------------|------------------|------------------|-------------------|
| 1. 2×2 | 6. 4×5 | 11. 2×1 | 16. 2×10 |
| 2. 5×6 | 7. 4×3 | 12. 2×8 | 17. 2×11 |
| 3. 3×2 | 8. 2×4 | 13. 3×8 | 18. 2×12 |
| 4. 2×3 | 9. 3×4 | 14. 3×7 | 19. 3×12 |
| 5. 3×3 | 10. 2×7 | 15. 2×9 | 20. 3×11 |

21. 3×10	32. 4×7	43. 6×3	54. 5×10
22. 3×1	33. 4×1	44. 5×1	55. 4×10
23. 3×9	34. 7×9	45. 6×5	56. 6×6
24. 2×5	35. 7×3	46. 6×4	57. 9×9
25. 2×6	36. 4×11	47. 5×7	58. 6×10
26. 3×5	37. 5×2	48. 6×7	59. 5×11
27. 3×6	38. 6×2	49. 6×8	60. 5×12
28. 4×4	39. 4×9	50. 5×8	61. 6×12
29. 4×2	40. 7×2	51. 5×9	62. 6×9
30. 4×6	41. 5×3	52. 6×1	63. 6×11
31. 4×8	42. 5×5	53. 5×4	64. 4×12

Multiply :

65. 7×7	82. 8×10	99. 10×1	116. 10×8
66. 7×1	83. 7×10	100. 11×4	117. 9×10
67. 8×2	84. 7×11	101. 12×4	118. 12×8
68. 9×6	85. 8×11	102. 9×5	119. 12×9
69. 9×3	86. 7×12	103. 10×5	120. 11×8
70. 7×4	87. 8×12	104. 12×5	121. 12×1
71. 8×5	88. 9×1	105. 12×6	122. 12×10
72. 7×5	89. 9×2	106. 10×12	123. 12×11
73. 7×6	90. 10×2	107. 10×6	124. 9×11
74. 8×3	91. 11×2	108. 11×6	125. 9×12
75. 8×4	92. 11×9	109. 11×5	126. 10×9
76. 8×6	93. 12×2	110. 11×1	127. 10×10
77. 8×1	94. 10×3	111. 9×7	128. 10×11
78. 8×7	95. 11×3	112. 10×7	129. 11×10
79. 8×8	96. 12×3	113. 11×7	130. 11×11
80. 7×8	97. 9×4	114. 12×7	131. 11×12
81. 8×9	98. 10×4	115. 9×8	132. 12×12

Fill the blanks with the proper factors:

- | | | |
|----------------------|------------------------|------------------------|
| 133. $3 \times = 27$ | 146. $\times 7 = 56$ | 159. $12 \times = 36$ |
| 134. $4 \times = 32$ | 147. $\times 9 = 81$ | 160. $12 \times = 60$ |
| 135. $7 \times = 49$ | 148. $\times 8 = 64$ | 161. $11 \times = 44$ |
| 136. $9 \times = 72$ | 149. $\times 3 = 27$ | 162. $12 \times = 72$ |
| 137. $2 \times = 6$ | 150. $\times 9 = 63$ | 163. $\times 11 = 55$ |
| 138. $7 \times = 28$ | 151. $\times 10 = 100$ | 164. $\times 12 = 48$ |
| 139. $6 \times = 30$ | 152. $\times 12 = 144$ | 165. $\times 10 = 60$ |
| 140. $4 \times = 28$ | 153. $8 \times = 48$ | 166. $\times 10 = 70$ |
| 141. $3 \times = 30$ | 154. $8 \times = 64$ | 167. $\times 7 = 63$ |
| 142. $5 \times = 45$ | 155. $9 \times = 27$ | 168. $\times 2 = 24$ |
| 143. $7 \times = 42$ | 156. $9 \times = 45$ | 169. $\times 3 = 36$ |
| 144. $5 \times = 40$ | 157. $11 \times = 121$ | 170. $\times 4 = 48$ |
| 145. $6 \times = 54$ | 158. $11 \times = 110$ | 171. $\times 12 = 108$ |

Find the products of:

172. 2, 3, 4, 5, 7, 8, 9, by 2
173. 1, 5, 6, 7, 4, 3, 8, by 4
174. 8, 7, 6, 4, 5, 3, 2, by 5
175. 12, 11, 10, 8, 9, 7, 6, by 7
176. 5, 6, 8, 7, 2, 3, 4, by 7
177. 3, 2, 5, 8, 9, 10, 11, by 3
178. 9, 8, 6, 7, 4, 5, 12, by 8
179. 10, 11, 12, 9, 8, 7, 6, by 9
180. 2, 3, 4, 9, 10, 11, 12, by 10
181. 9, 8, 7, 6, 5, 4, 3, by 11
182. 10, 12, 9, 11, 7, 6, 3, by 12
183. 12 by 1, 2, 6, 7, 8, 9
184. 9 by 3, 4, 7, 2, 5, 6

185. How many are $(3 \times 5) + (4 \times 6)$?

SOLUTION.— $3 \times 5 = 15$; $4 \times 6 = 24$; $15 + 24 = 39$.

Find the sums:

186. $(4 \times 10) + (3 \times 11)$

190. $(7 \times 7) + (8 \times 4)$

187. $(7 \times 9) + (4 \times 6)$

191. $(9 \times 4) + (3 \times 7)$

188. $(6 \times 3) + (2 \times 8)$

192. $(6 \times 6) + (2 \times 4)$

189. $(5 \times 5) + (6 \times 6)$

193. $(5 \times 4) + (3 \times 6)$

Find the remainders:

194. $(6 \times 4) - (2 \times 3)$

198. $(9 \times 8) - (6 \times 4)$

195. $(8 \times 3) - (4 \times 4)$

199. $(10 \times 11) - (5 \times 3)$

196. $(7 \times 6) - (6 \times 5)$

200. $(6 \times 5) - (7 \times 2)$

197. $(5 \times 3) - (2 \times 2)$

201. $(8 \times 6) - (9 \times 5)$

Find the products:

202. $(6 + 7) \times (7 - 2)$

206. $(13 - 2) \times (3 + 8)$

203. $(9 + 8) \times (8 - 3)$

207. $(25 - 5) \times (6 - 2)$

204. $(10 + 6) \times (5 - 2)$

208. $(15 + 3) \times (8 - 6)$

205. $(11 + 12) \times (12 - 5)$

209. $(17 - 3) \times (3 + 6)$

Find the products:

210. 13×2

216. 16×2

222. 15×6

228. 20×5

211. 13×3

217. 16×3

223. 14×5

229. 25×2

212. 13×5

218. 17×5

224. 15×6

230. 30×3

213. 14×2

219. 18×2

225. 14×7

231. 33×2

214. 15×3

220. 18×4

226. 13×6

232. 34×2

215. 16×5

221. 19×5

227. 13×7

233. ~~50~~ $\times 2$

Find the products of the following:

	234.	235.	236.	237.	238.	239.	240.
Multiplicand	9	8	7	4	3	12	13
Multiplier	<u>5</u>	<u>9</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>11</u>	<u>10</u>
Product	241. 22 <u>2</u>	242. 33 <u>4</u>	243. 50 <u>2</u>	244. 24 <u>4</u>	245. 25 <u>4</u>	246. 26 <u>3</u>	
	247. 315 <u>2</u>	248. 243 <u>4</u>	249. 649 <u>5</u>	250. 281 <u>8</u>	251. 276 <u>7</u>		
	252. 1204 <u>5</u>	253. 5214 <u>3</u>	254. 6078 <u>8</u>	255. 2134 <u>12</u>	256. 3120 <u>11</u>		
	257. 67321 <u>5</u>	258. 55555 <u>6</u>	259. 43712 <u>4</u>	260. 62137 <u>7</u>			
	261. 1270345 <u>11</u>	262. 8906543 <u>12</u>	263. 6540210 <u>9</u>				

Find the products:

264. $2 \times 2 \times 2$	270. $6 \times 7 \times 2$	276. $6 \times 4 \times 3 \times 2$
265. $3 \times 3 \times 3$	271. $3 \times 4 \times 6$	277. $2 \times 3 \times 9 \times 3$
266. $4 \times 3 \times 4$	272. $2 \times 10 \times 2$	278. $8 \times 8 \times 2 \times 4$
267. $6 \times 5 \times 7$	273. $3 \times 11 \times 3$	279. $2 \times 2 \times 3 \times 4$
268. $8 \times 9 \times 5$	274. $3 \times 2 \times 8$	280. $3 \times 4 \times 2 \times 4$
269. $4 \times 5 \times 3$	275. $9 \times 5 \times 2$	281. $5 \times 5 \times 2 \times 4$

Read the products rapidly :

282. 1×2 ; 10×2 ; 100×2 ; 1000×2 .

283. 20×2 ; 30×2 ; 40×2 ; 50×2 ; 60×2 ; 80×2 .

284. 5×4 ; 50×4 ; 500×4 ; 5000×4 ; 60×4 ; 600×4 .

285. 7×5 ; 70×5 ; 700×5 ; 7000×5 ; 80×5 ; 800×5 .

It will be observed that the product of 7 by 5 is the same, whatever order of units 7 may represent.

286. 700×6 ; 600×7 ; 900×4 ; 500×9 ; 400×8 .

287. 2000×4 ; 5000×7 ; 3000×8 ; 8000×5 .

288. Multiply 20, 200, 2000, by all the numbers from 3 to 9 inclusive.

289. Multiply 30, 300, 3000, by the same multipliers as in the preceding example.

290. In the same manner proceed with all the similar numbers to 90, 900, 9000.

Give the products of the following :

291.	292.	293.	294.	295.	296.
300	400	500	600	800	900
<u>4</u>	<u>7</u>	<u>5</u>	<u>6</u>	<u>3</u>	<u>2</u>

297.	298.	299.	300.	301.	302.
3000	4000	5000	6000	80000	90000
<u>4</u>	<u>7</u>	<u>5</u>	<u>6</u>	<u>3</u>	<u>2</u>

303. $24 \times 10 =$

306. $20 \times 200 =$

304. $20 \times 20 =$

307. $18 \times 1000 =$

305. $36 \times 100 =$

308. $20 \times 2000 =$

Find the products of the following :

	234.	235.	236.	237.	238.	239.	240.
Multiplicand	9	8	7	4	3	12	13
Multiplier	<u>5</u>	<u>9</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>11</u>	<u>10</u>
Product	241. 22 <u>2</u>	242. 33 <u>4</u>	243. 50 <u>2</u>	244. 24 <u>4</u>	245. 25 <u>4</u>	246. 26 <u>3</u>	
	247. 315 <u>2</u>	248. 243 <u>4</u>	249. 649 <u>5</u>	250. 281 <u>8</u>	251. 276 <u>7</u>		
	252. 1204 <u>5</u>	253. 5214 <u>3</u>	254. 6078 <u>8</u>	255. 2134 <u>12</u>	256. 3120 <u>11</u>		
	257. 67321 <u>5</u>	258. 55555 <u>6</u>	259. 43712 <u>4</u>	260. 62137 <u>7</u>			
	261. 1270345 <u>11</u>	262. 8906543 <u>12</u>	263. 6540210 <u>9</u>				

Find the products :

264. $2 \times 2 \times 2$	270. $6 \times 7 \times 2$	276. $6 \times 4 \times 3 \times 2$
265. $3 \times 3 \times 3$	271. $3 \times 4 \times 6$	277. $2 \times 3 \times 9 \times 3$
266. $4 \times 3 \times 4$	272. $2 \times 10 \times 2$	278. $8 \times 8 \times 2 \times 4$
267. $6 \times 5 \times 7$	273. $3 \times 11 \times 3$	279. $2 \times 2 \times 3 \times 4$
268. $8 \times 9 \times 5$	274. $3 \times 2 \times 8$	280. $3 \times 4 \times 2 \times 4$
269. $4 \times 5 \times 3$	275. $9 \times 5 \times 2$	281. $5 \times 5 \times 2 \times 4$

Read the products rapidly :

282. 1×2 ; 10×2 ; 100×2 ; 1000×2 .

283. 20×2 ; 30×2 ; 40×2 ; 50×2 ; 60×2 ; 80×2 .

284. 5×4 ; 50×4 ; 500×4 ; 5000×4 ; 60×4 ; 600×4 .

285. 7×5 ; 70×5 ; 700×5 ; 7000×5 ; 80×5 ; 800×5 .

It will be observed that the product of 7 by 5 is the same, whatever order of units 7 may represent.

286. 700×6 ; 600×7 ; 900×4 ; 500×9 ; 400×8 .

287. 2000×4 ; 5000×7 ; 3000×8 ; 8000×5 .

288. Multiply 20, 200, 2000, by all the numbers from 3 to 9 inclusive.

289. Multiply 30, 300, 3000, by the same multipliers as in the preceding example.

290. In the same manner proceed with all the similar numbers to 90, 900, 9000.

Give the products of the following :

291.	292.	293.	294.	295.	296.
300	400	500	600	800	900
<u>4</u>	<u>7</u>	<u>5</u>	<u>6</u>	<u>3</u>	<u>2</u>

297.	298.	299.	300.	301.	302.
3000	4000	5000	6000	80000	90000
<u>4</u>	<u>7</u>	<u>5</u>	<u>6</u>	<u>3</u>	<u>2</u>

303. $24 \times 10 =$

306. $20 \times 200 =$

304. $20 \times 20 =$

307. $18 \times 1000 =$

305. $36 \times 100 =$

308. $20 \times 2000 =$

PROBLEMS.

21. 1. At \$9 a ton, how much will 3 tons of hay cost?

SOLUTION. — $3 \times \$9 = \27 . Three tons of hay will cost \$27.

2. At 8 cents a quart, how much will 4 quarts of blueberries cost?

3. If you answer 11 questions at each recitation, how many questions will you answer at 3 recitations? at 4?

4. What is the cost of 4 pairs of shoes, at \$3 a pair?

5. If a ream of paper costs \$3, how much will 2 reams cost? 3 reams? 4 reams?

6. Eight quarts make a peck. How many quarts are there in 3 pecks? in 4 pecks? in 5 pecks?

7. At 12 cents a yard, how much will 3 yards of cloth cost? 4 yards?

8. If you recite 8 perfect lessons every week, how many will you recite in 5 weeks? in 6 weeks? in 7 weeks?

9. How much will 6 pounds of sugar cost, at 5 cents a pound? at 6 cents?

10. If you write 5 lines a day, how many lines will you write in 4 days? in 7 days?

11. What is the cost of 5 yards of ribbon, at 8 cents a yard? at 9 cents?

12. What is the cost of 7 barrels of apples, at \$2 a barrel?

13. At \$12 a ton, how much will 6 tons of hay cost? 7 tons? 5 tons?

14. If a boat sails 9 miles an hour, how far will she sail in 4 hours? in 6 hours? in 7 hours?

15. How much will 7 barrels of flour cost, at \$6 a barrel?

16. There are 7 days in 1 week. How many days are there in 5 weeks? in 6 weeks? in 9 weeks?

17. How much will 8 barrels of flour cost, at \$9 a barrel?

18. How much will 9 dozen chairs cost, at \$10 a dozen?

19. If it takes 4 horses to draw a heavy wagon, how many horses will be required to draw 7 such wagons?

20. If Henry can earn \$10 in one month, how many dollars can he earn in 8 months? in 9 months? in 7 months?

21. If 8 men can do a piece of work in 7 days, how many days will it take 1 man to do it?

22. If 2 barrels of flour last 8 persons 3 months, how long will they last one person?

23. If there are 10 windows in a house, how many windows will there be in 12 similar houses?

24. A farmer divided his farm into 9 fields, containing 11 acres each. How many acres were there in his farm?

25. If a man travels 6 miles an hour, how far will he travel in 8 hours? in 9 hours? in 11 hours? in 6 hours?

26. When eggs are 11 cents a dozen, what will be the cost of 7 dozen? of 9 dozen? of 10 dozen?

27. How much will 11 roses cost, at 10 cents apiece?

28. What will be the cost of 12 barrels of pork, at \$11 a barrel?

29. How much will 11 yards of cloth cost, at \$6 a yard?

30. In an orchard there are 12 rows of trees, and 11 trees in each row. How many trees are there in the orchard?

31. How much will 11 tables cost, at \$6 apiece?

32. At \$12 a hundred, how much will 7 hundred oak posts cost? 9 hundred? 11 hundred?

33. At \$ 11 a week, how much will 5 weeks' board cost ? 8 weeks' ? 11 weeks' ? 12 weeks' ?

34. If the fare for one person from Albany to Boston is \$ 5, what will the fare be for 11 persons ? for 9 persons ? for 12 persons ?

35. At \$ 12 a month, how many dollars can a boy earn in 4 months ? in 6 months ? in 9 months ? in 12 months ?

36. If it takes 11 yards of cloth for one dress, how many yards will be required to make 4 dresses ? 7 dresses ?

37. If I have 7 cases, each containing 12 cans of fruit, how many cans of fruit have I ?

38. If I put \$ 8 in the savings bank every month, how many dollars shall I deposit in a year ?

39. What will 11 pounds of rice cost, at 9 cents a pound ?

40. If a quantity of provisions will last 9 men 12 days, how long will the same quantity last 1 man ?

41. When flour is worth \$ 7 a barrel, how much must be paid for 11 barrels ? for 12 barrels ?

42. What is the cost of 3 cows, at \$ 23 apiece ?

43. At 31 cents a bushel, what is the cost of 6 bushels of oats ?

44. What is the cost of 7 bushels of apples, at 25 cents a bushel ?

45. If a man travels 26 miles in 1 day, how far can he travel in 10 days ?

46. If I have 6 beds of pansies containing 18 plants each, how many pansy plants have I altogether ?

47. Edwin is 17 years old, and his father is 4 times as old. How old is his father ?

48. At \$ 50 a share, how much will 7 shares of bank stock cost ?

49. How much will 9 pounds of tea cost, at 56 cents a pound?

50. At 44 cents a day, how much will 10 days' labor amount to?

51. At \$ 3 a yard, what will be the cost of a piece of cloth containing 36 yards?

52. If a steamship consumes 125 tons of coal a day, how much will she consume in a voyage lasting 4 days?

53. If I have 7 cards containing 24 buttons each, and 5 loose buttons, how many buttons have I in all?

54. In an orchard there are 16 peach trees, and 6 times as many apple trees. How many apple trees are there in the orchard?

55. If it takes a boy 5 minutes to work one example, how long will it take him to work 45 such examples?

56. If 11 men can do a piece of work in 13 days, in what time can 1 man do the same work?

57. If a man labors 12 months for \$ 17 a month, how much will his wages amount to at the end of the year?

58. If there are 318 bricks in one load, how many bricks will there be in 3 such loads?

59. If in an orchard there are 12 rows of trees, and 32 trees in each row, how many trees are there in the orchard?

60. If a man can dig 28 bushels of potatoes in 1 day, how many bushels can he dig in 3 days? in 4 days? in 5 days?

61. At \$ 80 apiece, what will be the cost of 3 horses? of 4 horses? of 6 horses?

62. At \$ 43 an acre, how much will 10 acres of land cost? 12 acres?

63. If 8 horses eat 3 bushels of oats in 1 day, how many bushels will they eat in 7 days? in 9 days?

64. What will be the cost of 6 tons of coal at \$5 a ton, and of 4 cords of wood at \$3 a cord?

SOLUTION. — They will cost the sum of the products of 6×5 dollars and of 4×3 dollars. $6 \times \$5 = \30 , and $4 \times \$3 = \12 . $\$30 + \$12 = \$42$, which is the entire cost.

65. A man sold 12 umbrellas at \$4 each, and 9 canes at \$2 each. How much did he receive for all?

66. What will be the cost of 5 pounds of coffee at 35 cents a pound, and 14 pounds of rice at 9 cents a pound?

67. If two persons start from the same point, and travel in opposite directions, one at the rate of 6 miles an hour and the other at the rate of 4 miles an hour, how far apart will they be in 7 hours? in 9 hours? in 12 hours?

68. If they travel in the same direction, how far apart will they be in 5 hours? in 7 hours? in 24 hours?

69. If I hire a man and his son to work for me, the father at \$14 a week and the son at \$8, how much will be due them both in 6 weeks? in 9 weeks?

70. Edwin has 16 marbles, and Henry has 3 times as many. How many have they together?

71. A farmer paid his hired man \$18 a month for 3 months, and an assistant \$10 a month for 2 months. How much money did he pay them both?

72. John bought 9 oranges at 4 cents apiece, 7 lemons at 3 cents apiece, and 10 apples at 2 cents apiece. How much did they all cost?

73. Charles is twice as old as Frank, and Frank is 14 years old. What is the sum of their ages?

74. In an art school there are 5 classes of 16 pupils each, 3 classes of 8 pupils each, and 2 classes of 10 pupils each. How many pupils are there in the school?

75. In a train, 3 cars contain 30 passengers each, 2 cars 35 passengers each, and in the remaining car there

are 40 passengers. How many passengers are there on that train ?

76. If one boy earns 12 cents a day, another 15 cents a day, and a third 20 cents a day, how much can the 3 boys earn in 5 days ?

77. A man bought 9 yards of cloth for a suit of clothes, at \$ 5 a yard ; he paid \$ 7 for making the coat, \$ 2 for making the trousers, and \$ 1 for making the vest. How much did his suit cost him ?

78. A farmer bought a horse for \$ 85, for which he gave 7 tons of hay at \$ 9 a ton, and the remainder in money. How much money did he pay ?

79. John worked 5 days for 15 cents a day, and Edwin worked 4 days for 20 cents a day. How much more did Edwin earn than John ?

80. A drover bought 35 sheep at \$ 2 a head, and sold them for \$ 90. How much did he gain ?

81. In a drug store there are 5 shelves holding 32 bottles each, and 5 drawers holding 12 bottles each. How many more bottles can be placed on the shelves than in the drawers ?

82. If a man earns 90 cents a day, and pays 40 cents a day for his board, how much will he save in 6 days ?

83. A farmer sold a grocer 7 pounds of butter at 30 cents a pound, and received in payment 12 pounds of sugar at 6 cents a pound. How much was still due the farmer ?

84. My bookcase has 7 shelves. By laying the books flat I can place 18 on a shelf, but only 15 books can stand upright on each shelf. How many more books can I place on the shelves by laying them flat, than by letting them stand ?

85. A merchant poured into a cask 14 quarts of oil at 3 different times, and from the same cask he filled 2 cans,

holding 8 quarts each, and 3 jugs, holding 6 quarts each. How many quarts remained in the cask?

86. Nellie picked 6 quarts of blackberries, and Laura picked 5 quarts less than 4 times as many. How many quarts did Laura pick?

87. What is the difference in the cost of 30 yards of cloth at \$4 a yard, and 25 yards at \$3 a yard?

88. If you have 50 books and give away 3 to each of 6 friends, and 2 to each of 4 friends, how many books will you have left?

89. A drover bought 50 sheep for \$125; he sold 30 at \$4 a head, and the remainder at \$3 a head. How many dollars did he gain by the transaction?

90. Three boys were talking of their money; Louis said he had 35 cents, Henry said he had twice as much, and John said with 10 cents more he would have as much as both the others. How many cents had John?

91. Two men bought a horse for \$75; they paid \$2 a week for keeping him, and at the end of 12 weeks sold him for \$90. How much did they lose?

92. A man, owing \$100, gave in payment a sleigh worth \$40, 12 cords of wood, at \$3 a cord, and the remainder in money. How much money did he pay?

93. A book had 3 chapters of 20 pages each, and 4 chapters of 18 pages each. After reading 100 pages of the book, how much more must I read to finish it?

94. If a blacksmith earns \$14 a week, and a carpenter \$11 a week, what will be the difference in their earnings in 12 weeks?

95. In one toy window there are 5 boxes holding 4 dolls each, and in another 6 boxes holding 3 dolls each. If 7 are sold from the first window and 5 from the second, how many dolls will there be left in both windows?

DIVISION.

22. Division is the process of finding how many times one number is contained in another, or of separating a number into equal parts.

23. The Dividend is the number to be divided.

24. The Divisor is the number by which to divide.

25. The Quotient is the result obtained by the division, and shows how many times the divisor is contained in the dividend.

26. The Remainder is the part of the dividend left when the divisor is not contained in it an exact number of times.

27. The Sign of Division is $+$, and is read *divided by*. When placed between two numbers it shows that the number on the left is to be divided by the number on the right.

Thus, $25 \div 5$ is read 25 *divided by* 5, and shows that 25 is to be divided into 5 parts, or that we are to find how many times 5 is contained in 25.

28. Division is also indicated by writing the dividend above the divisor with a line between them, or by writing the divisor at the left of the dividend with a line between them.

Thus, $\begin{array}{r} 25 \\ 5 \end{array}$ and $5 \overline{)25}$ show that 25 is to be divided by 5.

29. 1. How many times is 2 contained in 2? in 4? 6? 8? 10? 12? 20? 50? 32? 28? 40? 16?

2. How many times is 3 contained in 3? in 6? 9? 12? 15? 21? 18? 30? 60? 24? 27? 42?

3. How many times is 4 contained in 4? in 8? 20? 12? 16? 40? 36? 72? 44? 48? 96? 80?

4. Divide the following numbers by 5:

10, 20, 15, 25, 30, 35, 40, 45, 50, 60, 100, 80, 75, 65.

5. Divide by 6:

6, 18, 24, 12, 30, 42, 48, 60, 54, 66, 78, 72, 96, 90, 84.

6. What numbers besides 6 are contained an exact number of times in each of the numbers in example 5?

7. Divide by 7:

14, 7, 21, 35, 28, 42, 49, 63, 77, 56, 70, 84, 98, 91.

8. Divide by 8:

8, 24, 32, 16, 40, 56, 48, 72, 80, 64, 96, 88, 104.

9. Divide by 9:

9, 36, 45, 18, 27, 54, 72, 63, 81, 99, 90, 108, 117.

10. Divide by 10:

10, 20, 50, 70, 60, 40, 30, 80, 100, 90, 110, 120.

11. Divide by 11:

22, 44, 88, 11, 33, 66, 22, 55, 77, 99, 110, 121.

12. Divide by 12:

12, 24, 48, 36, 60, 84, 72, 96, 132, 120, 108, 144.

Supply the quotients:

- | | | |
|-------------------|-------------------|---------------------|
| 13. $35 \div 5 =$ | 22. $36 \div 9 =$ | 31. $20 \div 4 =$ |
| 14. $32 \div 8 =$ | 23. $30 \div 6 =$ | 32. $27 \div 9 =$ |
| 15. $21 \div 7 =$ | 24. $35 \div 7 =$ | 33. $72 \div 8 =$ |
| 16. $27 \div 3 =$ | 25. $10 \div 5 =$ | 34. $90 \div 10 =$ |
| 17. $16 \div 8 =$ | 26. $63 \div 7 =$ | 35. $55 \div 11 =$ |
| 18. $12 \div 4 =$ | 27. $56 \div 8 =$ | 36. $60 \div 12 =$ |
| 19. $14 \div 7 =$ | 28. $42 \div 6 =$ | 37. $144 \div 12 =$ |
| 20. $24 \div 3 =$ | 29. $45 \div 5 =$ | 38. $132 \div 11 =$ |
| 21. $30 \div 5 =$ | 30. $54 \div 6 =$ | 39. $99 \div 11 =$ |

Supply a divisor to fill each blank:

- | | | |
|-------------------------|--------------------------|---------------------------|
| 40. $72 \div \quad = 9$ | 45. $18 \div \quad = 6$ | 50. $60 \div \quad = 6$ |
| 41. $81 \div \quad = 9$ | 46. $25 \div \quad = 5$ | 51. $60 \div \quad = 15$ |
| 42. $36 \div \quad = 9$ | 47. $49 \div \quad = 7$ | 52. $99 \div \quad = 11$ |
| 43. $45 \div \quad = 9$ | 48. $60 \div \quad = 30$ | 53. $108 \div \quad = 12$ |
| 44. $16 \div \quad = 4$ | 49. $60 \div \quad = 12$ | 54. $72 \div \quad = 6$ |

Supply a dividend to fill each blank:

- | | | |
|-------------------------|--------------------------|--------------------------|
| 55. $\quad \div 5 = 20$ | 60. $\quad \div 9 = 10$ | 65. $\quad \div 12 = 12$ |
| 56. $\quad \div 6 = 16$ | 61. $\quad \div 10 = 15$ | 66. $\quad \div 9 = 8$ |
| 57. $\quad \div 7 = 14$ | 62. $\quad \div 11 = 4$ | 67. $\quad \div 12 = 10$ |
| 58. $\quad \div 8 = 12$ | 63. $\quad \div 6 = 25$ | 68. $\quad \div 10 = 6$ |
| 59. $\quad \div 3 = 25$ | 64. $\quad \div 4 = 30$ | 69. $\quad \div 11 = 7$ |

70. How many times is 2 contained in 60? 3 in 60?
4 in 60? 5? 6? 10? 12? 15?

Divide:

- 71. 72 by 2, 4, 3, 8, 6, 9, 12, 18, 24.
- 72. 56 by 7, 8, 4, 2, 14, 28.
- 73. 24 by 2, 6, 4, 8, 3, 12.
- 74. 36 by 4, 9, 2, 12, 3, 18, 6.
- 75. 54 by 2, 3, 6, 9, 18, 27.
- 76. 80 by 5, 10, 2, 4, 8, 16, 40, 20.
- 77. 45 by 3, 9, 5, 15.
- 78. 42 by 7, 6, 2, 3, 14, 21.
- 79. 24 by 8, 3, 4, 2, 12, 6.
- 80. 40 by 2, 5, 8, 10, 20, 4.
- 81. 48 by 6, 8, 2, 3, 12, 24, 4, 16.
- 82. 32 by 2, 4, 8, 16.
- 83. 30 by 5, 6, 3, 2, 15, 10.
- 84. 45 by 3, 9, 5, 15.
- 85. 80 by 5, 10, 20, 40, 2, 4, 8, 16.
- 86. 96 by 2, 3, 6, 12, 24, 16, 4, 8, 32.
- 87. 63 by 3, 9, 7, 21.
- 88. 84 by 3, 2, 7, 21, 6, 12, 4, 14.
- 89. 90 by 2, 5, 3, 9, 6, 18, 10, 15, 30.
- 90. 108 by 3, 2, 9, 6, 4, 12, 18.
- 91. 100 by 10, 20, 5, 4, 2, 25, 50.
- 92. 99 by 9, 3, 11, 33.
- 93. 66 by 6, 3, 2, 11, 22, 33.
- 94. 75 by 5, 3, 15, 25.
- 95. 88 by 2, 4, 8, 11, 22, 44.
- 96. 120 by 2, 5, 10, 15, 6, 12, 4, 3, 8, 20.
- 97. 140 by 5, 7, 4, 2, 10, 14, 20, 35.
- 98. 200 by 5, 10, 25, 2, 4, 8, 20.

99. How many times 9 is 6×6 ?
100. How many times 4 is 5×8 ?
101. How many times 8 is 6×12 ?
102. How many times 10 is 5×20 ?
103. How many times 15 is 3×25 ?
104. How many times 20 is 10×12 ?
105. How many times 16 is 8×8 ?
106. How many times 28 is 7×16 ?
107. How many times 25 is 5×30 ?
108. How many times 20 is 12×10 ?
109. 16×4 is how many times 8?
110. 9×12 is how many times 6?
111. 8×14 is how many times 16?
112. 4×42 is how many times 12?
113. 7×18 is how many times 9?
114. 14×10 is how many times 28?
115. 12×5 is how many times 10?
116. 16×9 is how many times 4?
117. How many times $9 + 3$ is 6×12 ?
118. How many times $18 - 2$ is 8×12 ?
119. How many times $12 - 7$ is 10×8 ?
120. 8×12 is how many times $64 \div 8$?
121. 6×20 is how many times $60 \div 12$?
122. 9×10 is how many times 5? 18? 15? 3? 6?
123. 7×14 is how many times 14? 2? 7?
124. 8×9 is how many times 2? 12? 4? 3? 6?
8? 18? 24? 36?
125. 9×6 is how many times 3? 9? 2? 6? 18? 27?
126. 18×5 is how many times 9? 2? 3? 6? 10? 15?
127. 24×10 is how many times 12? 5? 3? 16? 15? 6?

Give the quotients :

128.	129.	130.	131.	132.
2) <u>468</u>	3) <u>966</u>	4) <u>8444</u>	5) <u>5105</u>	6) <u>6666</u>

133.	134.	135.	136.
6) <u>182430</u>	7) <u>714287</u>	8) <u>816248</u>	9) <u>9182736</u>

137.	138.	139.
10) <u>10765320</u>	11) <u>25965511</u>	12) <u>24486012</u>

140.	141.	142.
9) <u>11110518</u>	10) <u>306987520</u>	8) <u>790123216</u>

Read the quotients rapidly :

143. $4 \div 2 =$ $40 \div 2 =$ $400 \div 2 =$ $4000 \div 2 =$

144. $12 \div 2 =$ $120 \div 2 =$ $1200 \div 2 =$ $12000 \div 2 =$

145. $15 \div 5 =$ $150 \div 5 =$ $1500 \div 5 =$ $15000 \div 5 =$

146. $45 \div 5 =$ $450 \div 5 =$ $4500 \div 5 =$ $45000 \div 5 =$

147. $24 \div 3 =$ $240 \div 3 =$ $2400 \div 3 =$ $24000 \div 3 =$

148. $56 \div 8 =$ $560 \div 8 =$ $5600 \div 8 =$ $56000 \div 8 =$

149. $\frac{16}{8} =$ $\frac{160}{8} =$ $\frac{1600}{8} =$ $\frac{16000}{8} =$

150. $\frac{36}{6} =$ $\frac{360}{6} =$ $\frac{3600}{6} =$ $\frac{36000}{6} =$

151. How many 2's are there in 648 ?

Observe that $648 = 600 + 40 + 8$; the number of 2's in each is at once obvious. Adding these, $300 + 20 + 4 = 324$, the number of 2's in 648.

152. How many 3's are there in 960 ? in 639 ? in 969 ?

153. How many 4's are there in 440 ? in 844 ? in 888 ?

154. How many 6's are there in 696 ? in 366 ? in 906 ?

Read the quotients rapidly :

$$155. \frac{505}{5} = \quad 157. \frac{808}{4} = \quad 159. \frac{806}{8} = \quad 161. \frac{510}{5} =$$

$$156. \frac{797}{7} = \quad 158. \frac{806}{2} = \quad 160. \frac{404}{4} = \quad 162. \frac{444}{4} =$$

$$163. 24 \div 6 = \quad 165. 360 \div 6 = \quad 167. 5400 \div 6 =$$

$$164. 21 \div 7 = \quad 166. 280 \div 7 = \quad 168. 3500 \div 7 =$$

Divide :

$$169. \quad 8752 \text{ by } 4$$

$$177. \quad 83210 \text{ by } 5$$

$$170. \quad 7625 \text{ by } 5$$

$$178. \quad 60210 \text{ by } 6$$

$$171. \quad 7122 \text{ by } 6$$

$$179. \quad 57384 \text{ by } 4$$

$$172. \quad 5343 \text{ by } 3$$

$$180. \quad 89005 \text{ by } 7$$

$$173. \quad 8561 \text{ by } 7$$

$$181. \quad 347802 \text{ by } 3$$

$$174. \quad 9024 \text{ by } 8$$

$$182. \quad 987000 \text{ by } 8$$

$$175. \quad 76344 \text{ by } 6$$

$$183. \quad 703218 \text{ by } 6$$

$$176. \quad 90324 \text{ by } 9$$

$$184. \quad 630940 \text{ by } 5$$

Find the value of each of the following expressions in a single number :

$$\begin{array}{r} 185. \\ 21 - 9 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 186. \\ 43 - 7 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 187. \\ 12 \times 5 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 188. \\ 9 \times 8 \\ \hline 12 \end{array}$$

$$\begin{array}{r} 189. \\ 14 + 34 \\ \hline 12 \end{array}$$

$$\begin{array}{r} 190. \\ 42 + 36 - 14 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 191. \\ 45 + 4 - 4 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 192. \\ 128 \times 3 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 193. \\ 28 \times 16 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 194. \\ 242 \times 21 \\ \hline 7 \end{array}$$

Find the quotients :

$$195. 47000 \div 10 \quad 198. 3000 \div 10 \quad 201. 137000 \div 10$$

$$196. 47000 \div 100 \quad 199. 3000 \div 100 \quad 202. 137000 \div 100$$

$$197. 47000 \div 1000 \quad 200. 3000 \div 1000 \quad 203. 137000 \div 1000$$

PROBLEMS.

30. 1. When wheat is \$ 2 a bushel, how many bushels can be bought for \$ 12 ?

SOLUTION.—2 dollars is contained in 12 dollars 6 times. At \$ 2 a bushel, 6 bushels of wheat can be bought for \$ 12.

2. How many peaches, at 2 cents apiece, can be bought for 18 cents ?

3. If you can buy one lead pencil for 3 cents, how many can you buy for 24 cents ?

4. At \$ 4 a cord, how many cords of wood can be bought for \$ 16 ?

5. At 3 cents apiece, how many oranges can be bought for 21 cents ?

6. In how many days can a man earn \$ 20, if he earns \$ 2 a day ?

7. Edward has 15 peaches, which he wishes to divide equally among his 3 brothers. How many must he give to each ?

8. How many tons of coal, at \$ 5 a ton, can be bought for \$ 45 ?

9. If one penholder costs 4 cents, how many can be bought for 20 cents ? for 32 cents ? for 40 cents ?

10. I want to divide 36 marbles equally among 3 boys. How many marbles should each boy receive ?

11. How many barrels of apples, at \$ 3 a barrel, can be bought for \$ 36 ?

12. If you give 44 cents to 4 children, how much does each child receive ?

13. If a man walks 3 miles an hour, how many hours will it take him to walk 30 miles ?

14. If I want to divide 27 pieces of chalk equally *among 3 classes*, how many must I give to each class ?

15. How many spools of thread, at 5 cents a spool, can be bought for 40 cents? for 50 cents?

16. When lard is 7 cents a pound, how many pounds can be bought for 56 cents? for 63 cents?

17. If a farmer divides 84 bushels of potatoes equally among 7 laborers, how many bushels will each receive?

18. If an orchard contains 64 trees in rows having 8 trees in each row, how many rows are there?

19. If a man, traveling at a uniform rate, travels 72 miles in 6 hours, how far does he travel in one hour?

20. Edwin paid 7 cents for his ball. How many balls, at the same price apiece, could he buy for 28 cents? for 56 cents? for 84 cents?

21. How many bins will be required to hold 72 bushels of wheat, if each bin contains 8 bushels?

22. If one shelf holds 8 books, how many shelves would be filled by 48 books? by 64 books?

23. At 8 cents a pound, how many pounds of sugar can be bought for 96 cents?

24. If a man spends 5 cents a day for newspapers, in how many days will his paper bill amount to 60 cents?

25. A man bought some sheep for \$48, at \$4 apiece. How many sheep did he buy?

26. If one man can do a piece of work in 60 days, in what time can 5 men do the same work if they work at the same rate?

SOLUTION.—5 men work 5 times as quickly as 1 man, therefore, if the 60 days' work is divided among 5 men, it will take $60 \div 5$, or 12 days.

27. If 6 men receive \$72 for building a barn, how many dollars will each man receive?

28. If 9 boys share equally the sum of 81 cents, how much will each boy receive?

29. A man sold a wagon for \$ 77, and took his pay in hay at \$ 11 a ton. How many tons did he receive ?

30. How long will it take 12 men to perform a piece of work that 1 man can do in 48 days ?

31. If \$ 108 was paid for 9 thousand feet of lumber, what was the cost of a thousand feet ?

32. If I receive \$ 56 in \$ 2 bills, how many bills shall I have ?

33. If I wish to distribute 60 plants equally along the 4 sides of my garden, how many plants must I put on each side ?

34. When meat is 10 cents a pound, how many pounds can be bought for 50 cents ? for 80 cents ? for 100 cents ?

35. At 11 cents a pound, how many pounds of sugar can be bought for 88 cents ? for 99 cents ?

36. A teacher divided 132 children into 11 equal classes. How many children were there in each class ?

37. A farmer sold a horse for \$ 120. How many cows, at \$ 12 each, would pay for the horse ? How many young cattle at \$ 8 each ? How many sheep at \$ 5 each ?

38. If a girl can solve 25 examples in an hour, how long, at that rate, will it take her to solve 75 examples of the same kind ?

39. If a boy reads 7 pages a day, how long will it take him to read 56 pages ? 84 pages ? 98 pages ?

40. How long will it take a train to travel 45 miles, if it travels 15 miles every hour ?

41. If 1 man can do a piece of work in 72 days, in what time can 6 men do it ? 8 men ? 9 men ? 12 men ?

42. If a certain quantity of provisions will last 1 man 36 days, how many days will it last 4 men ? 9 men ? 12 men ?

43. A boy earns \$ 66 in 11 weeks, working 6 days each week. How much does he earn in 1 week? How much in 1 day?

44. If a painter receives \$ 100 for painting 5 carriages, how much does he receive for each?

45. How many lots, containing 12 acres each, can be sold from a farm of 120 acres? How many lots of 20 acres each?

46. If a ship sails 11 miles an hour, how long will she be in sailing 44 miles? 88 miles? 110 miles?

47. How many men, at \$ 8 a month, can be hired one month for \$ 96? How many at \$ 12? How many at \$ 16?

48. If I travel 120 miles in 6 days, how many miles do I travel in 1 day?

49. If 3 pounds of coffee cost 27 cents, how much will 6 pounds cost?

SOLUTION. — One pound will cost 9 cents; 6 pounds will cost 6×9 cents, or 54 cents.

Or, 6 pounds will cost twice as much as 3 pounds, and 2×27 cents = 54 cents.

50. If 4 yards of broadcloth cost \$ 20, how much will 8 yards cost?

51. If 6 boys can hoe 54 rows of potatoes in one day, how many rows can 12 boys hoe?

52. If a man travels 40 miles in 8 hours, how far will he travel in 4 hours? in 16 hours?

53. How long will it take me to read 7 pages of a book, if I can read 5 pages in 20 minutes?

54. If 9 weeks' board costs \$ 45, how much will 4 weeks' board cost? 7 weeks'? 12 weeks'?

55. If a boy earns 60 cents in 5 days, how many cents can he earn in 12 days? in 20 days?

56. How much will 10 bundles of wood cost, if 6 bundles cost 12 cents ?

57. At the rate of 12 tops for 120 marbles, how many marbles will a boy receive in exchange for 14 tops ?

58. If 18 apples are worth 6 peaches, how many apples are 15 peaches worth ? 20 peaches ?

59. If a stagecoach runs 48 miles in 8 hours, in how many hours will it run 60 miles ?

60. If 15 yards of cloth cost \$ 75, how much will 40 yards cost ?

61. How many melons can be bought for \$ 1, at the rate of 3 for 60 cents ?

62. What will 42 pounds of beef cost, if 7 pounds cost 56 cents ?

63. When apples are sold at the rate of 4 barrels for \$ 8, how many barrels must be given for 3 tons of coal at \$ 6 a ton ?

64. How many boards 12 inches wide would cover the same space as 15 boards 8 inches wide ?

65. If a farmer exchanges 5 tubs of butter, worth \$ 12 a tub, for cloth worth \$ 4 a yard, how many yards will he receive ?

66. I have 5 pictures of the same kind which together are worth \$ 25. How many books worth \$ 3 apiece could I obtain in exchange for 3 of my pictures ?

67. If 6 bushels of wheat are worth \$ 12, how many bushels of wheat must be given for 9 tons of hay, worth \$ 10 a ton ?

68. At the rate of 3 for 4 cents, how many pears can be bought for 24 cents.

SOLUTION. — 24 cents is 6×4 cents. Therefore 6×3 pears, or 18 pears, can be bought.

69. A man paid 72 cents for some oranges, at the rate of 5 for 12 cents. How many oranges did he buy ?

70. How many pounds of nails may be bought for 60 cents, if 4 pounds cost 20 cents ?

71. When eggs are sold at the rate of 9 for 11 cents, how many must I sell to receive 99 cents ?

72. If 3 men can do a piece of work in 12 days, how many days will it take 9 men to do the same work ?

SOLUTION. — It will take one man 3×12 , or 36 days ; and 9 men, $36 \div 9$, or 4 days.

73. If 6 men can build a wall in 8 days, how many men will be required to build it in 4 days ?

74. If 4 men can dig a ditch in 10 days, how many days will it take 1 man to dig it ? 5 men ? 8 men ?

75. How long will it take 7 men to reap a field, if it takes 14 men 2 days to reap it ?

76. If 5 boys can water a garden in 8 minutes, how many boys would it take to water it in 1 minute ?

77. A man bought some oranges for 44 cents, at the rate of 5 for 11 cents, and divided them equally among his 4 children. How many did he give to each ?

78. If by working 15 days a man earned enough to buy 10 pictures costing \$6 apiece, how much did he receive a day ?

79. A man engaged to labor 5 months for \$80, but he continued 3 months longer at the same rate. What amount was due him for the whole time ?

80. If you pay 60 cents for some lemons, at the rate of 6 for 10 cents, and sell them at the rate of 9 for 20 cents, how much will you gain ?

81. If two ships are 120 miles apart, and sail directly toward each other, one at the rate of 9 miles an hour, and the other at the rate of 11 miles an hour, in how many hours will they meet ?

82. A tailor owed for 7 weeks' board at \$6 a week, and in addition for \$18 which he had borrowed. How

many vests, worth \$ 5 apiece, must he sell in order to be able to pay his debts ?

83. If a man receives 16 pounds of sugar in exchange for 20 pounds of cheese at 8 cents a pound, what is the price of the sugar per pound ?

84. James paid 36 cents for some oranges at 3 cents apiece, and, after eating 5 of them, he exchanged the remainder, at 4 cents apiece, for a knife. How much did the knife cost him ?

85. A fruit vender bought 30 peaches at the rate of 2 for 3 cents, which he sold at the rate of 3 for 7 cents ; but by an oversight, he gave one of his customers 10 cents too much change. Did he gain or lose by the transaction, and how much ?

86. A farmer sold 9 head of cattle at \$ 12 a head, and 11 bushels of wheat at \$ 2 a bushel. How many yards of cloth, at \$ 2 a yard, will pay the debt ?

87. If I buy 40 turkeys at the rate of 5 for \$ 3, and sell them at the rate of 8 for \$ 7, how much do I gain ?

88. If a merchant buys 12 drums for \$ 15, at what price must he sell each of them to gain \$ 9 on the cost ?

89. If 5 men buy a mowing machine for \$ 120, and rent it 3 weeks for \$ 15 a week, and then sell it for \$ 100, what is each man's share of the gain ?

90. If 5 barrels of flour are worth \$ 30, how many yards of cloth, worth \$ 3 a yard, will 2 barrels of the flour buy ?

91. Four men agree to build 120 rods of wall for \$ 48, and to share equally ; but when the wall is half built 2 men quit, and the others finish it. How much should each receive ?

92. I have \$ 75. How many vases can I buy, at the rate of 3 for \$ 7, and have \$ 12 left ?

93. A man, having \$80, bought 9 cords of wood at \$4 a cord, 3 barrels of flour at \$8 a barrel, and the remainder he expended for cloth at \$4 a yard. How many yards of cloth did he buy?

94. If 4 bushels of wheat are worth 12 bushels of corn, how many bushels of corn are equal in value to 10 bushels of wheat?

95. If 12 bushels of wheat yield 3 barrels of flour, how many bushels of wheat will yield 7 barrels?

96. A cistern holding 140 gallons has a pipe by which 30 gallons will run into the cistern in one hour, and another that will discharge 20 gallons in an hour. When both are running, in what time will the cistern be filled?

97. If a quantity of provisions serves 7 men 12 days, how long would it serve 4 men?

98. A merchant bought 15 bushels of clover seed for \$75; he wishes to keep 3 bushels for his own use, and to sell the remainder so as to make \$9 on the first cost of the whole. How much must he demand for a bushel?

99. A man bought a pair of horses for \$80 each; he spent \$40 in fitting them for market, and then sold them for \$300. Did he gain or lose by the transaction, and how much?

100. A tailor bought 15 yards of one kind of cloth for \$60, and 25 yards of another kind for \$75. What was the difference in the price per yard of the first cloth and the second?

101. A lady having 36 miles the start of her son, travels by carriage at the rate of 6 miles an hour; her son follows her, traveling by bicycle at the rate of 9 miles an hour. In how many hours will he overtake her?

DENOMINATE NUMBERS.

31. A Denominate Number is a number composed of one or more units of any denomination. It may be simple or compound.

32. A Simple Denominate Number is a number composed of but one denomination.

Thus, 5 days, and 6 yards are simple denominate numbers.

33. A Compound Denominate Number is a number composed of two or more denominations of the same nature.

Thus, 3 weeks, 5 days; and 10 yards, 6 inches are compound denominate numbers.

34. Reduction is the process of changing a number from one denomination to another without altering its value.

35. A number is changed to a *lower denomination* when it is changed to a denomination of less unit value.

Thus, \$ 1 = 10 dimes = 100 cents.

36. A number is changed to a *higher denomination* when it is changed to a denomination of greater unit value.

Thus, 100 cents = 10 dimes = \$ 1.

37. Currency Tables are measures of money values, and vary with the countries in which they are used.

38. The Measures of Weight are *Troy Weight*, *Avoirdupois Weight*, and *Apothecaries' Weight*. *Troy Weight* is used in weighing gold, silver, and precious stones; *Avoirdupois Weight*, for the ordinary purposes of weighing; and *Apothecaries' Weight*, in weighing medicines for prescriptions.

39. The Measures of Extension are *Long Measure*, *Square Measure*, and *Cubic Measure*. *Long Measure* is used in measuring lengths or distances; *Square Measure*, in computing areas or surfaces; *Cubic Measure*, in estimating the contents of solids.

40. The Measures of Capacity are *Liquid Measure* and *Dry Measure*. *Liquid Measure* is used in measuring liquids; *Dry Measure*, in measuring dry substances.

41. Time Measure is used in measuring the lapse of time.

42. Circular Measure is used in measuring circles and angles in surveying, geography, astronomy, etc.

43. Besides the above there are miscellaneous measures for counting, paper, etc.

44. The Metric System is a system of weights and measures based on a scale of 10. It includes measures of currency, weight, extension, and capacity.

CURRENCY.

45. UNITED STATES MONEY.

10 cents (¢) = 1 dime	d.
10 d. = 1 dollar	\$
\$ 10 = 1 eagle	E.

Dollars and cents are separated by a period, thus:
2 dollars and 10 cents, or 210 cents, is written \$ 2.10.

46. ENGLISH MONEY.

4 farthings (far.) = 1 penny	d.
12d. = 1 shilling	s.
20s. = 1 pound or sovereign	£ or sov.

MEASURES OF WEIGHT.

47. TROY WEIGHT.

24 grains (gr.) = 1 pennyweight	dwt. or pwt.
20 dwt. = 1 ounce	oz.
12 oz. = 1 pound	lb.

48. AVOIRDUPOIS WEIGHT.

16 ounces (oz.) = 1 pound	lb.
100 lb. = 1 hundredweight	cwt.
20 cwt. = 1 ton	T.

49. APOTHECARIES' WEIGHT.

20 grains (gr.) = 1 scruple	℥
3 ℥ = 1 dram	ʒ
8 ʒ = 1 ounce	℥
12 ℥ = 1 pound	lb

METRIC MEASURE OF WEIGHT

50. The **Gram**, the metric unit of weight, is equal to nearly $15\frac{1}{2}$ Troy grains.

10 centigrams (cg.)	= 1 decigram dg.
10 dg.	= 1 gram g.
10 g.	= 1 dekagram Dg.
10 Dg.	= 1 hectogram Hg.
10 Hg.	= 1 kilogram or kilo . . . Kg.

MEASURES OF EXTENSION.

51. LONG MEASURE.

12 inches (in.)	= 1 foot ft.
3 ft.	= 1 yard yd.
$5\frac{1}{2}$ yd. or $16\frac{1}{2}$ ft.	= 1 rod rd.
320 rd.	= 1 mile mi.
5280 ft.	= 1 mile.

METRIC LONG MEASURE.

52. The **Meter**, the metric unit of length, is equal to about $39\frac{1}{8}$ inches.

10 centimeters (cm.)	= 1 decimeter dm.
10 dm.	= 1 meter m.
10 m.	= 1 dekameter Dm.
10 Dm.	= 1 hectometer Hm.
10 Hm.	= 1 kilometer Km.
10 Km.	= 1 myriameter Mm.

53.**SQUARE MEASURE.**

144 square inches (sq. in.)	= 1 square foot sq. ft.
9 sq. ft.	= 1 square yard . . . sq. yd.
30 $\frac{1}{4}$ sq. yd.	= 1 square rod sq. rd.
160 sq. rd.	= 1 acre A.
640 acres	= 1 square mile . . . sq. mi.

METRIC SQUARE MEASURE.

54. The **Are**, the unit of metric square measure, is equal to over 119 $\frac{1}{2}$ square yards.

1 centare (ca.)	= 1 square meter . . . sq. m.
100 ca.	= 1 are a.
100 a.	= 1 hectare Ha.
100 Ha.	= 1 square kilometer . sq. Km.

55.**CUBIC MEASURE.**

1728 cubic inches (cu. in.)	= 1 cubic foot cu. ft.
27 cu. ft.	= 1 cubic yard cu. yd.
16 cu. ft.	= 1 cord foot cd. ft.
8 cd. ft. or 128 cu. ft.	= 1 cord of wood Cd.

METRIC CUBIC MEASURE.

56. The **Stere**, or **Cubic Meter**, the unit of metric cubic measure, is equal to a little over one quarter of a cord.

10 decisteres (dst.)	= 1 stere st.
10 st.	= 1 dekastere Dst.

MEASURES OF CAPACITY.

57.

LIQUID MEASURE.

4 gills (gi.) = 1 pint pt.

2 pt. = 1 quart qt.

4 qt. = 1 gallon gal.

58.

DRY MEASURE.

2 pints (pt.) = 1 quart qt.

8 qt. = 1 peck pk.

4 pk. = 1 bushel bu.

METRIC MEASURE OF CAPACITY.

59. The Liter, the metric unit of capacity, is nearly equal to one quart liquid measure.

10 deciliters (dl.) = 1 liter l.

10 l. = 1 dekaliter Dl.

10 Dl. = 1 hectoliter Hl.

MISCELLANEOUS TABLES.

60.

TIME MEASURE.

60 seconds (sec.) = 1 minute min.

60 min. = 1 hour hr.

24 hr. = 1 day da.

7 da. = 1 week wk.

12 mo. = 1 year yr.

365 da. = 1 common year.

366 da. = 1 leap year.

100 yr. = 1 century C.

The divisions of the year, the names of the months and the number of days in each, are shown in the following table:

Winter.	{ 1st	month, January	has 31 days.
	2d	" February	" 28* "
Spring.	{ 3d	" March	" 31 "
	4th	" April	" 30 "
	5th	" May	" 31 "
Summer.	{ 6th	" June	" 30 "
	7th	" July	" 31 "
	8th	" August	" 31 "
Autumn.	{ 9th	" September	" 30 "
	10th	" October	" 31 "
	11th	" November	" 30 "
Winter.	12th	" December	" 31 "

The following lines will help to remember the number of days in each month :

Thirty days has September,
 April, June, and November ;
 All the rest have thirty-one,
 Save February, which alone
 Has twenty-eight ; and one day more
 We add to it, one year in four.

61.**CIRCULAR MEASURE.**

60 seconds (")	= 1 minute '
60'	= 1 degree °
30°	= 1 sign S.
12 S. or 360°	= 1 circle C.

* In leap year, 29.

62.

COUNTING.

12 units = 1 dozen doz.

12 doz. = 1 gross gro.

12 gro. = 1 great gross . g. gro.

20 units = 1 score sc.

63.

PAPER.

24 sheets = 1 quire qre.

20 qre. = 1 ream rm.

64. Change each of the following to cents:

1. \$ 3 4. 6 d. 7. 3 E. 10. \$ 8.43

2. 4 d. 5. 5 d. 8. 9 d. 11. \$ 7.63

3. 5 E. 6. \$ 4. 9. \$ 9 12. \$ 9.49

Change each of the following to dimes:

13. 100¢ 16. 50¢ 19. 250¢ 22. \$ 4.35

14. 1 E. 17. \$ 6 20. 370¢ 23. \$ 6.50

15. \$ 5 18. 9 E. 21. 840¢ 24. \$ 7.80

Change to dollars:

25. 200¢ 27. 3 E. 29. 90 d.

26. 600¢ 28. 5 E. 30. 40 d.

Change to eagles:

31. \$ 20 33. 3000¢ 35. 100 d.

32. 400 d. 34. \$ 80 36. 6000¢

Change to farthings:

37. 10s. 38. £ 1 5d. 39. 2s. 40. 5s. 41. 8d.

Change to pence:

42. 20s. 43. £ 2 44. 36 far. 45. £ 10 46. 7s.

Change to shillings:

47. 48 far. 48. 36d. 49. £ 7 50. 60d. 51. £ 3

Change to pounds sterling:

52. 960 far. 53. 480d. 54. 60s.

55. 960d. 56. 120s.

Change to grains (Troy):

57. 2 dwt. 58. 3 oz. 59. 1 lb.

60. 1 oz. 1 dwt. 61. 3 dwt. 4 gr.

Change to pennyweight:

62. 3 lb. 63. 4 oz. 64. 48 gr.

65. 1 lb. 3 oz. 66. 72 gr.

Change to ounces (Troy):

67. 480 gr. 68. 60 dwt. 69. 3 lb. 2 oz. 70. 40 dwt.

Change to pounds (Troy):

71. 240 dwt. 73. 5760 gr.

72. 24 oz. 74. 48 oz.

Change to ounces (Avoirdupois):

75. 3 lb. 76. 2 cwt. 77. 1 T. 2 cwt. 78. 4 lb. 6 oz.

Change to pounds (Avoirdupois):

79. 32 oz. 80. 300 cwt. 81. 2 T. 2 cwt. 82. 48 oz.

Change to hundredweight:

83. 300 lb. 85. 4800 oz.

84. 3 T. 4 cwt. 86. 1 T. 200 lb.

Change to tons:

87. 40 cwt. 89. 32000 oz.

88. 8000 lb. 90. 12000 lb.

Change to grains (Apothecaries') :

91. 3 \oslash 92. 4 z 93. 2 ʒ 94. 1 lb 1 ʒ 95. 3 z 2 \oslash

Change to scruples :

96. 40 gr. 97. 12 z 98. 2 ʒ 1 z
 99. 3 lb 100. 1 lb 4 ʒ

Change to drams :

101. 12 \oslash 102. 120 gr. 103. 180 gr.
 104. 4 ʒ 105. 2 lb 3 ʒ

Change to ounces (Apothecaries') :

106. 3 lb 2 ʒ 107. 24 z 108. 96 \oslash
 109. 480 gr. 110. 960 \oslash

Change to pounds (Apothecaries') :

111. 24 ʒ 112. 192 z 113. 288 \oslash 114. 5760 gr.

Change to centigrams :

115. 2 dg. 117. 3 Dg. 119. 1 Kg. 3 g.
 116. 4 g. 118. 5 Hg. 1 Dg. 120. 2 Dg. 2 dg.

Change to decigrams :

121. 30 cg. 123. 2 Dg. 1 g. 125. 2 Kg.
 122. 3 g. 124. 4 Hg. 126. 1 Hg. 2 g.

Change to grams :

127. 30 dg. 128. 400 cg. 129. 3 Dg. 4 g.
 130. 2 Hg. 131. 5 Kg. 6 Dg.

Change to dekagrams :

132. 20 g. 134. 5 Hg. 3 Dg.
 133. 300 dg. 4000 cg. 135. 1 Kg. 20 g.

Change to hectograms :

136. 1 Kg. 5 Hg. 137. 40 Dg. 138. 300 g.
139. 5000 dg. 140. 100 g. 40000 cg.

Change to kilograms :

141. 40 Hg. 142. 500 Dg. 143. 7000 g.
144. 30000 dg. 145. 200000 cg.

Change to inches :

146. 3 ft. 147. 1 yd. 2 ft. 148. 4 rd.
149. 1 mi. 150. 3 ft. 6 in.

Change to feet :

151. 2 yd. 1 ft. 152. 24 in. 153. 4 rd.
154. 10 mi. 155. 1 yd. 48 in.

Change to yards :

156. 66 ft. 157. 2 rd. 158. 1 mi.
159. 1 mi. 5 yd. 160. 72 in.

Change to rods :

161. 1 mi. 17 rd. 162. 11 yd. 163. 33 ft.
164. 198 in. 165. 22 yd.

Change to miles :

166. 1760 yd. 168. 63360 in.
167. 5280 ft. 169. 640 rd.

Change to centimeters :

170. 3 dm. 171. 5 m. 1 dm. 172. 2 Dm.
173. 3 Hm. 1 Dm. 174. 1 Mm. 2 Km.

Change to decimeters :

175. 30 cm. 176. 11 m. 177. 4 Dm. 178. 3 Hm.
 179. 7 Km. 180. 1 Mm. 5 m.

Change to meters :

181. 70 dm. 183. 3 Dm. 7 m. 185. 2 Hm.
 182. 400 cm. 184. 9 Km. 5 m. 186. 4 Mm.

Change to dekameters :

187. 300 dm. 188. 20 m. 4000 cm. 189. 13 Hm.
 190. 5 Km. 191. 2 Mm.

Change to hectometers :

192. 1 Mm. 3 Km. 194. 400 m. •
 193. 2 Km. 30 Dm. 195. 7000 dm. 10000 cm.

Change to kilometers :

196. 30 Hm. 200 Dm. 198. 10 Hm. 3000 m.
 197. 4 Mm. 13 Km. 199. 10000 dm. 400000 cm.

Change to myriameters :

200. 30 Km. 400 Hm. 201. 5000 Dm. 70000 m.
 202. 800000 dm. 1000000 cm.

Change to square inches :

203. 3 sq. ft. 19 sq. in. 205. 2 sq. ft. 2 sq. in.
 204. 1 sq. yd. 206. 2 sq. yd. 3 sq. in.
 207. 20 sq. ft.

Change to square feet :

208. 288 sq. in. 210. 5 sq. yd.
 209. 3 sq. yd. 4 sq. ft. 211. 6 sq. yd. 2 sq. ft.

Change to square yards :

- | | |
|-----------------|-------------------|
| 212. 27 sq. ft. | 214. 1296 sq. in. |
| 213. 4 sq. rd. | 215. 54 sq. ft. |

• Change to square rods :

- | | |
|----------------------|-------------------|
| 216. 5 A. 6 sq. rd. | 218. 121 sq. yd. |
| 217. 3 A. 14 sq. rd. | 219. 1089 sq. ft. |

Change to acres :

- | | |
|---------------------|------------------|
| 220. 1 sq. mi. 1 A. | 221. 320 sq. rd. |
|---------------------|------------------|

Change to square miles :

- | | |
|--------------|---------------------|
| 222. 1280 A. | 223. 102400 sq. rd. |
|--------------|---------------------|

Change to centares :

- | | |
|---------------|-----------------------|
| 224. 3 sq. m. | 226. 7 Ha. |
| 225. 4 a. | 227. 2 sq. Km. 15 ca. |

Change to square meters :

- | | | |
|------------|-----------------|----------------------|
| 228. 3 ca. | 229. 1 Ha. 2 a. | 230. 3 sq. Km. 5 ca. |
|------------|-----------------|----------------------|

Change to ares :

- | | |
|--------------|-----------------|
| 231. 2 Ha. | 233. 500 sq. m. |
| 232. 700 ca. | 234. 3 sq. Km. |

Change to hectares :

- | | |
|-----------------------|-------------------|
| 235. 3 sq. Km. 14 Ha. | 237. 30000 ca. |
| 236. 500 a. | 238. 20000 sq. m. |

Change to sq. Km. :

- | | |
|---------------------|---------------------------|
| 239. 500 Ha. | 240. 30000 a. 1000000 ca. |
| 241. 7000000 sq. m. | |

Change to cubic inches :

- | | |
|----------------|--------------------------|
| 242. 3 cu. ft. | 244. 1 cd. ft. 2 cu. yd. |
| 243. 1 cu. yd. | 245. 10 cu. ft. |

Change to cubic feet :

- | | |
|-------------------|--------------------------|
| 246. 3456 cu. in. | 248. 2 Cd. 8 cd. ft. |
| 247. 3 cu. yd. | 249. 6 cu. yd. 2 cu. ft. |

Change to cubic yards :

- | | | |
|-----------------|-----------------|-----------------------|
| 250. 81 cu. ft. | 251. 27 cd. ft. | 252. 3 Cd. 21 cu. ft. |
|-----------------|-----------------|-----------------------|

Change to cord feet :

- | | |
|----------------------|----------------------|
| 253. 48 cu. ft. | 254. 3 Cd. 5 cd. ft. |
| 255. 2 Cd. 6 cd. ft. | |

Change to cords of wood :

- | | |
|-----------------|------------------|
| 256. 64 cu. ft. | 257. 256 cu. ft. |
| 258. 24 cd. ft. | |

Change to decisteres :

- | | |
|-------------|-------------------|
| 259. 5 st. | 261. 2 Dst. 7 st. |
| 260. 3 Dst. | 262. 3 Dst. |

Change to sterres :

- | | | |
|---------------|-------------|---------------------|
| 263. 200 dst. | 264. 6 Dst. | 265. 3 Dst. 40 dst. |
|---------------|-------------|---------------------|

Change to dekasteres :

- | | | |
|---------------|--------------|----------------------|
| 266. 500 dst. | 267. 210 st. | 268. 20 st. 300 dst. |
|---------------|--------------|----------------------|

Change to gills :

- | | |
|------------------|-------------------|
| 269. 3 pt. | 271. 4 gal. 3 gi. |
| 270. 2 qt. 1 pt. | 272. 1 gal. 3 qt. |

Change to pints (Liquid):

273. 36 gi.

275. 4 gal.

274. 3 qt.

276. 2 gal. 3 qt.

Change to quarts (Liquid):

277. 16 gal. 3 qt.

279. 32 gi.

278. 18 pt.

280. 36 pt.

Change to gallons:

281. 64 gi.

283. 64 qt.

282. 32 pt.

284. 64 pt.

Change to pints (Dry):

285. 13 qt.

286. 3 pk. 7 qt.

287. 4 bu. 4 qt. 1 pt.

Change to quarts (Dry):

288. 16 pt.

289. 3 pk. 5 qt.

290. 5 bu. 2 pk.

Change to pecks:

291. 3 bu. 2 pk.

293. 64 pt.

292. 32 qt.

294. 64 qt.

Change to bushels:

295. 128 pt.

296. 128 qt.

297. 16 pk.

Change to deciliters:

298. 3 l.

299. 12 Dl.

300. 7 Hl.

301. 50 Dl.

302. 20 Hl.

Change to liters:

303. 20 dl.

305. 4 Hl. 2 Dl.

304. 13 Dl.

306. 30 dl.

Change to dekaliters :

307. 40 l. 309. 2 HL
308. 120 l. 310. 500 dL

Change to hectoliters :

311. 2500 l. 312. 130 DL 3000 dL

Change to seconds :

313. 15 min. 314. 2 hr. 315. 10 hr. 3 min.
316. 5 min. 2 sec. 317. 240 min.

Change to minutes :

318. 120 sec. 319. 4 hr. 320. 5 da.

Change to hours :

321. 360 min. 323. 3 da. 17 hr. 325. 2 wk.
322. 3600 sec. 324. 20 da. 326. 60 da.

Change to days :

327. 96 hr. 328. 1440 min. 329. 86400 sec.
330. 3 wk. 331. 2 C. 1 yr.

Change to weeks :

332. 49 da. 333. 168 hr. 334. 84 da.

Change to months :

335. 25 yr. 336. 14 yr. 11 mo. 337. 3 C. 2 yr.

Change to years :

338. 3 C. 95 yr. 340. 730 da.
339. 96 mo. 341. 1095 da.

Change to centuries :

342. 500 yr. 343. 12000 mo. 344. 300 yr.

Change to seconds (Circular) :

345. 4' 30" 346. 5° 347. 1 S.

348. 3° 349. 25'

Change to minutes :

350. 360" 351. 3° 10' 352. 2 S.

353. 540" 354. 1 C.

Change to degrees :

355. 360' 356. 7200" 357. 4 S. 13°

358. 540' 359. 5 S. 17°

Change to signs :

360. 270° 361. 3600' 362. 108000"

363. 330° 364. 7200'

Change to units :

365. 11 doz. 366. 3 gro. 367. 1 g. gro.

368. 4 sc. 369. 3 doz. 11 u.

Change to dozen :

370. 72 u. 372. 5 g. gro.

371. 3 gro. 4 doz. 373. 3 se.

Change to gross :

374. 144 doz. 376. 4 g. gro.

375. 288 u. 377. 432 u.

Change to great gross :

378. 144 gro. 379. 576 doz. 380. 72 gro.

Change to score :

381. 40 u. 382. 120 u. 383. 3400 u. 384. 5600 u.

Change to sheets of paper :

385. 4 qre. 386. 3 rm. 387. 2 rm. 8 qre.

Change to quires :

388. 120 sheets. 389. 5 rm. 3 qre. 390. 360 sheets.

Change to reams :

391. 960 sheets. 393. 2400 sheets.

392. 100 qre. 394. 1200 qre.

PROBLEMS.

65. 1. If James earned \$ 12 and his father 3 eagles, how many dollars did they both earn ?

2. A man has 4 eagles, 4 five-dollar bills, and 4 dimes. How many dollars and cents has he ?

3. How many dimes are equal to 40 cents ? to 70 cents ?

4. What is the difference in the cost of 8 yards of cloth at 2 dimes a yard, and 6 yards at 30 cents a yard ?

5. At 5 shillings a yard, how many pounds sterling will 20 yards of carpeting cost ?

6. At 10 shillings a pair, how many pairs of shoes can be bought for 2 sovereigns ?

7. What will be the cost in dollars and cents of a gold chain, weighing 15 pennyweight, at 8 dimes a pennyweight?

8. How many dollars will 350 pounds of flour cost, if 25 pounds cost 5 dimes?

9. How much will 1 ton 5 cwt. of hay cost, if 5 cwt. cost \$3?

10. How much will 2 T. 10 cwt. of coal cost at 30 cents a cwt.

11. If 8 ounces of tea cost 3 dimes, how much will 2 pounds cost?

12. What will be the cost of 240 pounds of sugar, at 7 cents a pound?

13. Which will cost the more, 500 pounds of fish at 6 cents a pound, or 3 tons of hay at 50 cents a cwt.?

14. How much will 3 pounds of powdered magnesia cost at 5 cents an ounce?

15. How many 10 grain powders can be made from an ounce of quinine?

16. If 5 grains of phenacetin cost 5 cents, how much will 1 pound cost?

17. If 1000 kilograms of hay cost \$10, how much will 50 kilograms cost?

18. If a boy walks 640 rods an hour, how long will it take him to walk 4 miles?

19. If a ship sails 5 miles an hour, how many days will she take to sail from New York to Liverpool, the distance being 3000 miles?

20. In 100 inches how many yards, feet, and inches are there?

21. At 8 dimes a foot, how many dollars will an iron railing 3 yd. 1 ft. long cost?

22. Find the sum in meters of 3 meters, 1 dekameter, and 2 hectometers.

23. I have a fence 2 rods 5 yards long, along whose top I wish to place nails 1 inch apart. How many nails shall I need for the whole length of the fence ?

24. From a piece of cloth containing 45 meters a tailor cut 5 pieces, each containing 7 meters. How many meters remained ?

25. At \$ 40 an acre, how much will 2 acres 16 sq. rods of land cost ?

26. At \$ 2 a square rod, how many acres of land may be bought for \$ 3200 ?

27. What will be the cost of plastering 90 sq. ft. of ceiling at 22 cents a sq. yd. ?

28. How much will 3 centares of plastering cost at 17 cents a square meter ?

29. How many cords of wood are there in a pile 8 ft. long, 5 ft. wide, and 8 ft. high ?

30. If 1 stere of marble costs \$ 15, what will be the cost of a dekastere ?

31. What will be the cost of 6 gallons of oil, at 15 cents a quart ?

32. If a pint of molasses costs 7 cents, how much will a gallon cost ?

33. If a can holds 2 quarts, how often must I fill it to empty a cask containing 3 gallons 2 quarts ?

34. If you should draw 3 quarts and 1 pint from a gallon of molasses, how many pints would remain ?

35. At 3 cents a pint, what will be the cost of 1 peck of chestnuts ?

36. If one bushel of hickory nuts costs \$ 1.60, what will be the cost of 6 quarts ?

37. I bought 2 pecks of cranberries for 96 cents, and sold them for 5 cents a pint. How much did I gain ?

38. If 1 liter of milk costs 4 cents, how much will 1 dekaliter cost ?

39. How much will 25 liters of oil cost, at 3 cents a liter ?

40. How many days are there from January 1st to March 10th, inclusive ?

41. How many days are there from April 10th to the 15th of June ?

42. How much time will a person gain by rising 30 minutes earlier than usual every day during the month of March ?

43. If a man earns \$36 every 3 weeks, what are his average earnings per working day ?

44. A ship during a storm changed her longitude 397 minutes. How many degrees and minutes did she change ?

45. I have 72 gross of buttons which I wish to place in boxes holding a dozen buttons each. How many boxes shall I need ?

46. A little girl gathered some roses, and tied them up in 10 bunches of a dozen roses each. How many roses had she gathered ?

47. A peddler sold me a box containing 3 great gross of shoe buttons. How many separate shoe buttons did I buy ?

48. A woman is 4 score years old, and her husband is 4 score years and 10. How old is each ?

49. A certain kind of paper is sold for \$4.80 a ream. How much is that per quire ? What is the cost of the paper per sheet ?

50. How much must I pay to have 5 reams of paper folded at the rate of 20 sheets for 1 cent ?

51. I have 5 quires of paper which I wish to divide equally among 6 children. How many sheets will each child receive ? How many more sheets would I need in *order to give each child a quire* ?

FACTORING.

66. The **Factors** of a number are the numbers which multiplied together produce the given number.

Thus, $3 \times 4 = 12$; $6 \times 2 = 12$. Therefore 3 and 4, or 6 and 2, are factors of 12.

67. An **Even Number** is a number exactly divisible by 2, and an **Odd Number** is a number not exactly divisible by 2.

Thus, 2, 4, 6, etc., are even numbers; 1, 3, 5, etc., are odd numbers.

68. A **Prime Number** is one that has no factors, and hence no divisors, except itself and 1.

Thus, 2, 3, 5, 7, 11, 13, etc., are prime numbers.

69. A **Composite Number** is one that has other factors beside itself and 1.

Thus, 9, 15, 18, etc., are composite numbers.

70. A **Prime Factor** is a factor or divisor which is a prime number.

Thus, 3 and 5 are prime factors of 15.

71. Numbers are **Prime** to each other when they have no common factors or divisors.

Thus, 9 and 16 are prime to each other.

72. An **Exact Divisor** of a number is one that will divide that number without a remainder.

Thus, 4 is an exact divisor of 16.

73. A Common Divisor of two or more numbers is a number that will exactly divide each of them.

Thus, 4 is a common divisor of 16 and 20.

74. The Greatest Common Divisor of two or more numbers is the *greatest* number that will exactly divide each of them.

Thus, 8 is the greatest common divisor of 8, 16, 24, and 32; 5 is the greatest common divisor of 15 and 30.

75. A Multiple of a number is a number exactly divisible by it.

Thus, 25 is a multiple of 5.

76. A Common Multiple of two or more numbers is a number exactly divisible by each of them.

Thus, 40 is a common multiple of 2, 4, 5, and 10.

77. The Least Common Multiple of two or more numbers is the *least* multiple exactly divisible by each of them.

Thus, although 40 is a *common multiple* of 2, 4, 5, and 10, the *least common multiple* of these four numbers is 20. The *least common multiple* of 3, 4, 6, and 8 is 24.

78. Cancellation is the process of rejecting equal factors from numbers sustaining to each other the relation of dividend and divisor.

Thus, in $8 \times 5 \div 6$, or $\frac{8 \times 5}{6}$, 6 is a factor of the dividend and 6 is the divisor. Since multiplying and dividing a number by the same number does not alter it, 5 multiplied and divided by 6 is 5; that is, the 6's cancel each other.

79. Name all the factors of:

1. 12	8. 35	15. 42	22. 65	29. 95
2. 18	9. 50	16. 45	23. 70	30. 55
3. 20	10. 60	17. 49	24. 72	31. 44
4. 25	11. 21	18. 54	25. 75	32. 33
5. 30	12. 24	19. 56	26. 80	33. 22
6. 16	13. 10	20. 63	27. 81	34. 99
7. 15	14. 28	21. 64	28. 90	35. 88

36. Name all the prime numbers to 100; all the composite numbers to 100.

37. Name the prime factors of: 15, 25, 30, 36, 45, 72.

38. Name all the exact divisors of: 4, 6, 8, 16, 25, 30.

Name common divisors of:

39. 2 and 4	43. 9 and 27	47. 35 and 60
40. 3 and 9	44. 4 and 24	48. 15 and 45
41. 5 and 25	45. 7 and 49	49. 12 and 36
42. 6 and 18	46. 16 and 24	50. 11 and 66

Name the *greatest* common divisors of:

51. 14 and 21	57. 9, 18, and 27
52. 80 and 48	58. 6, 18, and 24
53. 50 and 75	59. 4, 12, and 16
54. 8, 16, and 32	60. 4, 8, 18, and 30
55. 4, 12, and 20	61. 6, 9, 18, and 24
56. 5, 10, and 15	62. 12, 36, 60, and 72

Name common multiples of :

- | | | |
|----------|-------------|----------------|
| 63. 3, 5 | 66. 2, 9, 5 | 69. 3, 4, 5, 6 |
| 64. 2, 7 | 67. 2, 3, 4 | 70. 2, 4, 8, 3 |
| 65. 5, 9 | 68. 5, 4, 7 | 71. 9, 3, 6, 4 |

Find the *least* common multiples of :

- | | | |
|-----------------|------------------|-------------------|
| 72. 3, 5, 6 | 76. 3, 6, 2, 12 | 80. 4, 8, 16, 32 |
| 73. 4, 8, 12 | 77. 4, 6, 12, 24 | 81. 7, 4, 14, 28 |
| 74. 3, 6, 9 | 78. 4, 5, 10, 20 | 82. 8, 24, 16, 48 |
| 75. 2, 4, 5, 10 | 79. 6, 3, 8, 24 | 83. 6, 9, 18, 36 |

Divide, using cancellation :

- | | |
|--------------------------------|---|
| 84. $3 \times 8 \times 2$ by 3 | 90. $12 \times 8 \times 6$ by 3×2 |
| 85. $6 \times 8 \times 4$ by 8 | 91. $5 \times 6 \times 3$ by 2×3 |
| 86. $7 \times 3 \times 6$ by 2 | 92. $4 \times 3 \times 7$ by $2 \times 2 \times 3$ |
| 87. $2 \times 3 \times 4$ by 6 | 93. $8 \times 3 \times 2$ by $2 \times 3 \times 2$ |
| 88. $5 \times 2 \times 3$ by 6 | 94. $9 \times 15 \times 2$ by $5 \times 3 \times 2$ |
| 89. $9 \times 2 \times 6$ by 3 | 95. $7 \times 5 \times 4$ by $2 \times 7 \times 2$ |
96. $36 \times 10 \times 7$ by $14 \times 5 \times 9$
97. $21 \times 8 \times 40 \times 3$ by $12 \times 7 \times 20$
98. $64 \times 18 \times 9$ by $3 \times 9 \times 4 \times 16$
99. $24 \times 10 \times 16$ by $3 \times 5 \times 4 \times 16$
100. $36 \times 45 \times 81$ by $6 \times 5 \times 9 \times 64$
101. $72 \times 48 \times 56$ by $9 \times 6 \times 7$
102. $36 \times 18 \times 40$ by $9 \times 2 \times 12 \times 20$
103. $14 \times 16 \times 20$ by $7 \times 4 \times 5 \times 12$

PROBLEMS.

80. 1. A gardener exchanged 45 boxes of strawberries, worth 20 cents a box, for 20 pounds of tea. What was the cost of the tea, per pound?

2. John has 50 cents, Henry 35 cents, and William 60 cents, not in one-cent pieces, yet all in coins of one denomination. What is the denomination?

3. How many days' work, at 84 cents a day, will pay for 72 pounds of coffee at 28 cents a pound?

4. Mary has 35 scrap pictures, and Jane has 50. How may they arrange them in packages, so that each girl will have the same number in each parcel?

5. What is the smallest sum of money for which I could purchase an exact number of pictures, at \$ 5, or \$ 3, or \$ 4, or \$ 6 each?

6. A druggist sold 12 boxes of mineral water, containing 10 bottles each, at 6 cents a bottle. How many barrels of potatoes, containing 3 bushels each, at 90 cents a bushel, should he receive in exchange?

7. A real estate owner has 3 fields, the first containing 18, the second 36, and the third 72 acres, which he wishes to divide into the largest possible lots, having the same number of acres in each. How many acres must there be in each lot?

8. A farmer traded 30 pounds of butter at 36 cents a pound for molasses at 45 cents a gallon. How many gallons of molasses should he receive?

9. How many yards of calico, worth 12 cents a yard, should be given in exchange for 30 spools of cotton, at 4 cents a spool?

10. What will be the capacity of the smallest cask that will be filled to the brim by using a 2 pint, 3 pint, 5 pint, or 6 pint can to fill it?

FRACTIONS.



81. A **Fraction** is one or more of the equal parts into which a unit is divided.

82. When a unit is divided into 2 equal parts, one of the parts is called *one half*.

When a unit is divided into 3 equal parts, one of the parts is called *one third*; two of the parts are called *two thirds*; and three of the parts, *three thirds*, or *one unit*.

When a unit is divided into 4 equal parts, one of the parts is called *one fourth*; two of the parts are called *two fourths*; three of the parts, *three fourths*; and four of the parts, *four fourths*, or *one unit*.

83. Such parts as the above are expressed by figures as follows:

One half is written . . .	$\frac{1}{2}$	One sixth is written . . .	$\frac{1}{6}$
One third is written . . .	$\frac{1}{3}$	Five sixths is written . . .	$\frac{5}{6}$
Two thirds is written . . .	$\frac{2}{3}$	One seventh is written . . .	$\frac{1}{7}$
One fourth is written . . .	$\frac{1}{4}$	One eighth is written . . .	$\frac{1}{8}$
Two fourths is written . . .	$\frac{2}{4}$	Two ninths is written . . .	$\frac{2}{9}$
Three fourths is written . . .	$\frac{3}{4}$	Three tenths is written . . .	$\frac{3}{10}$
One fifth is written . . .	$\frac{1}{5}$	Four elevenths is written . . .	$\frac{4}{11}$
Two fifths is written . . .	$\frac{2}{5}$	Five twelfths is written . . .	$\frac{5}{12}$

84. The parts into which a unit is divided take *their value* as well as their *name* from the number

of parts. Each *third* is less in value than each *half*, because, if two things of the same size are divided respectively into 2 and 3 equal parts, one of the three equal parts must be smaller than one of the two. Similarly, each *fourth* is less than each *third*, each *fifth* than each *fourth*, and the greater the number of parts the less their value.

85. To write a fraction, we require one integer to express the number of parts into which the unit is divided, and another to show how many of these parts are taken.

Thus, in $\frac{3}{4}$, 4 shows into how many parts the unit is divided, and 3 shows the number of parts taken.

86. The **Denominator**, the number below the line, shows into how many parts the unit is divided.

87. The **Numerator**, the number above the line, shows how many parts are taken.

88. The **Terms** of a fraction are the numerator and denominator.

89. Fractions indicate *division*, the *numerator* corresponding to the *dividend*, and the *denominator* to the *divisor*. The fraction itself expresses the *quotient* of the numerator divided by the denominator.

Thus, $\frac{3}{4} = 3 \div 4$, and the quotient of $3 \div 4$ is *three fourths*.

90. A **Proper Fraction** is one whose numerator is less than its denominator, and whose value is therefore less than a unit.

Thus, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{3}$ are proper fractions.

91. An Improper Fraction is one whose numerator equals or exceeds its denominator, and whose value is equal to or greater than a unit.

Thus, $\frac{4}{3}$, $\frac{7}{5}$, $\frac{10}{8}$ are improper fractions.

92. A Mixed Number is a number expressed by an integer and a fraction.

Thus, $1\frac{1}{2}$, $3\frac{3}{4}$, $4\frac{1}{2}$ are mixed numbers.

93. Reduction of Fractions is the process of changing their form without changing their value.

94. A fraction is in its *lowest terms* when 1 is the greatest common divisor of the numerator and denominator.

95. 1. Since $\frac{1}{2}$ of a number is one of the two equal parts into which it is divided, what is $\frac{1}{2}$ of 4?

SOLUTION. — $\frac{1}{2}$ of 4 = $4 \div 2$, or 2.

2. What is $\frac{1}{3}$ of 9? of 18? of 27? of 36?

3. What is $\frac{2}{3}$ of 9?

SOLUTION. — 1 third of 9 = 3; 2 thirds of 9 = 2 times 3, or 6.

Find the results:

- | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|
| 4. $\frac{1}{3}$ of 12 | 12. $\frac{1}{6}$ of 12 | 20. $\frac{4}{7}$ of 21 | 28. $\frac{5}{8}$ of 24 |
| 5. $\frac{2}{3}$ of 15 | 13. $\frac{2}{8}$ of 18 | 21. $\frac{5}{7}$ of 28 | 29. $\frac{7}{8}$ of 40 |
| 6. $\frac{1}{4}$ of 16 | 14. $\frac{3}{8}$ of 12 | 22. $\frac{5}{7}$ of 42 | 30. $\frac{1}{3}$ of 45 |
| 7. $\frac{3}{4}$ of 20 | 15. $\frac{4}{6}$ of 24 | 23. $\frac{1}{8}$ of 16 | 31. $\frac{2}{3}$ of 18 |
| 8. $\frac{1}{6}$ of 25 | 16. $\frac{5}{8}$ of 36 | 24. $\frac{2}{8}$ of 24 | 32. $\frac{3}{8}$ of 27 |
| 9. $\frac{2}{3}$ of 10 | 17. $\frac{1}{7}$ of 35 | 25. $\frac{3}{8}$ of 32 | 33. $\frac{4}{5}$ of 36 |
| 10. $\frac{3}{5}$ of 15 | 18. $\frac{2}{7}$ of 14 | 26. $\frac{4}{8}$ of 24 | 34. $\frac{5}{8}$ of 45 |
| 11. $\frac{4}{5}$ of 20 | 19. $\frac{3}{7}$ of 35 | 27. $\frac{5}{8}$ of 16 | 35. $\frac{6}{8}$ of 45 |

- | | | | |
|--------------------------|--------------------------|---------------------------|---------------------------|
| 36. $\frac{7}{9}$ of 18 | 44. $\frac{7}{10}$ of 80 | 52. $\frac{8}{11}$ of 55 | 60. $\frac{4}{12}$ of 36 |
| 37. $\frac{8}{9}$ of 36 | 45. $\frac{8}{10}$ of 90 | 53. $\frac{7}{11}$ of 66 | 61. $\frac{5}{12}$ of 36 |
| 38. $\frac{1}{10}$ of 10 | 46. $\frac{9}{10}$ of 10 | 54. $\frac{8}{11}$ of 77 | 62. $\frac{9}{12}$ of 48 |
| 39. $\frac{2}{10}$ of 20 | 47. $\frac{1}{11}$ of 11 | 55. $\frac{9}{11}$ of 11 | 63. $\frac{7}{12}$ of 60 |
| 40. $\frac{3}{10}$ of 40 | 48. $\frac{2}{11}$ of 22 | 56. $\frac{10}{11}$ of 22 | 64. $\frac{8}{12}$ of 72 |
| 41. $\frac{4}{10}$ of 50 | 49. $\frac{3}{11}$ of 22 | 57. $\frac{1}{12}$ of 12 | 65. $\frac{9}{12}$ of 36 |
| 42. $\frac{5}{10}$ of 60 | 50. $\frac{4}{11}$ of 33 | 58. $\frac{2}{12}$ of 24 | 66. $\frac{10}{12}$ of 12 |
| 43. $\frac{6}{10}$ of 70 | 51. $\frac{5}{11}$ of 44 | 59. $\frac{3}{12}$ of 36 | 67. $\frac{11}{12}$ of 24 |

Change the following numbers to halves:

- | | | | | | |
|-------|-------|-------|-------|--------|--------|
| 68. 1 | 70. 3 | 72. 5 | 74. 7 | 76. 9 | 78. 25 |
| 69. 2 | 71. 4 | 73. 6 | 75. 8 | 77. 10 | 79. 50 |

Change to thirds:

- | | | | | | |
|--------|--------|--------|-------|-------|-------|
| 80. 5 | 82. 15 | 84. 16 | 86. 7 | 88. 4 | 90. 6 |
| 81. 10 | 83. 12 | 85. 13 | 87. 9 | 89. 2 | 91. 7 |

Change to fourths:

- | | | | | | |
|--------|--------|-------|-------|---------|---------|
| 92. 9 | 94. 27 | 96. 5 | 98. 7 | 100. 15 | 102. 20 |
| 93. 18 | 95. 30 | 97. 6 | 99. 4 | 101. 16 | 103. 60 |

How many fifths, sixths, sevenths, eighths, ninths, tenths, elevenths, and twelfths are there in each of the following?

- | | | | | | |
|--------|--------|--------|--------|---------|---------|
| 104. 5 | 106. 4 | 108. 3 | 110. 6 | 112. 8 | 114. 30 |
| 105. 2 | 107. 1 | 109. 9 | 111. 7 | 113. 10 | 115. 60 |

116. How many thirds are there in $6\frac{2}{3}$?

SOLUTION. — Since $1 = 3$ thirds, $6 = 6 \times 3$ thirds, or 18 thirds; 18 thirds + 2 thirds = 20 thirds. Therefore, $6\frac{2}{3} = 20$.

Reduce to improper fractions:

117. $2\frac{3}{4}$ 120. $6\frac{1}{8}$ 123. $9\frac{1}{8}$ 126. $6\frac{3}{4}$ 129. $4\frac{1}{11}$
 118. $5\frac{1}{2}$ 121. $7\frac{2}{3}$ 124. $10\frac{1}{10}$ 127. $8\frac{1}{2}$ 130. $3\frac{2}{3}$
 119. $4\frac{1}{2}$ 122. $8\frac{1}{8}$ 125. $3\frac{1}{5}$ 128. $9\frac{1}{10}$ 131. $5\frac{1}{4}$

132. How many units are there in $\frac{8}{2}$?

SOLUTION. — Since $\frac{1}{2} = 1$ unit, $\frac{8}{2} =$ as many units as 2 is contained times in 8, which is 4 times. Therefore, $\frac{8}{2} = 4$ units.

Or, since a fraction is an expression of division, $\frac{8}{2} = 8 \div 2 = 4$.

Change the following fractions to units:

133. $\frac{1}{2}$ 135. $\frac{2}{4}$ 137. $\frac{3}{6}$ 139. $\frac{5}{8}$ 141. $\frac{10}{10}$
 134. $\frac{1}{3}$ 136. $\frac{2}{5}$ 138. $\frac{4}{7}$ 140. $\frac{8}{9}$ 142. $\frac{7}{11}$

143. How many units are there in $\frac{8}{2}$?

SOLUTION. — Since $\frac{1}{2} = 1$ unit, $\frac{8}{2} =$ as many units as 2 is contained times in 8, which is 4 times. Therefore, $\frac{8}{2} = 4$.

Or, since a fraction is an expression of division, $8 \div 2 = 4$.

Reduce to mixed numbers:

144. $\frac{7}{8}$ 147. $\frac{1}{8}$ 150. $\frac{3}{8}$ 153. $\frac{1}{2}$ 156. $\frac{2}{5}$ 159. $\frac{5}{6}$
 145. $\frac{3}{8}$ 148. $\frac{3}{7}$ 151. $\frac{1}{11}$ 154. $\frac{1}{8}$ 157. $\frac{2}{8}$ 160. $\frac{3}{4}$
 146. $\frac{3}{4}$ 149. $\frac{1}{7}$ 152. $\frac{1}{11}$ 155. $\frac{1}{4}$ 158. $\frac{1}{7}$ 161. $\frac{1}{2}$

162. Change $\frac{1}{3}$ to sixths.

SOLUTION. — Multiplying or dividing both dividend and divisor by the same number does not alter the quotient. As the numerator of a fraction corresponds to a dividend and the denominator to a divisor, we may multiply them both by a number which will make the denominator 6, without altering the value of the fraction;

to obtain 6, 3 must be multiplied by 2. Therefore $\frac{1}{3} = \frac{1 \times 2}{3 \times 2} = \frac{2}{6}$

163. Change to twelfths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$.

164. Change to sixteenths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$.

165. Change to twentieths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$.

Change :

166. $\frac{1}{2}$ to 8ths	174. $\frac{2}{3}$ to 12ths
167. $\frac{1}{3}$ to 9ths	175. $\frac{4}{5}$ to 20ths
168. $\frac{1}{4}$ to 8ths	176. $\frac{3}{4}$ to 24ths
169. $\frac{1}{7}$ to 14ths	177. $\frac{5}{8}$ to 36ths
170. $\frac{1}{6}$ to 18ths	178. $\frac{7}{8}$ to 24ths
171. $\frac{1}{5}$ to 25ths	179. $\frac{3}{5}$ to 20ths
172. $\frac{1}{8}$ to 24ths	180. $\frac{4}{7}$ to 14ths
173. $\frac{1}{9}$ to 27ths	181. $\frac{5}{9}$ to 18ths

182. Change $\frac{4}{8}$ to halves.

SOLUTION. — To change the denominator 8 to 2, without altering the value of the fraction, each term of the fraction must be divided

$$\text{by 4. } \frac{4}{8} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}.$$

Change :

183. $\frac{3}{9}$ to 3ds	191. $\frac{9}{88}$ to 7ths
184. $\frac{4}{16}$ to 4ths	192. $\frac{8}{4}$ to 8ths
185. $\frac{4}{16}$ to 8ths	193. $\frac{9}{81}$ to 9ths
186. $\frac{5}{25}$ to 5ths	194. $\frac{10}{100}$ to 10ths
187. $\frac{4}{12}$ to 3ds	195. $\frac{6}{9}$ to 3ds
188. $\frac{5}{15}$ to 3ds	196. $\frac{8}{10}$ to 5ths
189. $\frac{4}{20}$ to 5ths	197. $\frac{4}{20}$ to 10ths
190. $\frac{6}{36}$ to 6ths	198. $\frac{9}{15}$ to 5ths

199. Reduce $\frac{6}{9}$ to its lowest terms.

SOLUTION. — Since a fraction is in its lowest terms when its numerator and denominator have no common divisor greater than 1, we must divide both terms of the fraction by their greatest common divisor; the greatest common divisor of 6 and 9 is 3;

$$\frac{6}{9} = \frac{6 \div 3}{9 \div 3} = \frac{2}{3}.$$

Reduce to their lowest terms :

200. $\frac{4}{12}$	205. $\frac{4}{10}$	210. $\frac{14}{12}$	215. $\frac{18}{8}$	220. $\frac{14}{12}$	225. $\frac{14}{12}$
201. $\frac{6}{18}$	206. $\frac{18}{8}$	211. $\frac{17}{12}$	216. $\frac{25}{8}$	221. $\frac{18}{8}$	226. $\frac{14}{8}$
202. $\frac{9}{18}$	207. $\frac{12}{8}$	212. $\frac{18}{8}$	217. $\frac{54}{4}$	222. $\frac{7}{8}$	227. $\frac{34}{8}$
203. $\frac{17}{12}$	208. $\frac{14}{12}$	213. $\frac{14}{8}$	218. $\frac{15}{8}$	223. $\frac{50}{8}$	228. $\frac{14}{8}$
204. $\frac{14}{12}$	209. $\frac{24}{8}$	214. $\frac{14}{12}$	219. $\frac{20}{12}$	224. $\frac{38}{8}$	229. $\frac{47}{8}$

230. Change $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having a common denominator.

SOLUTION. — If the denominator is common it must be a multiple of both 2 and 3; 12 is a multiple of both 2 and 3, so we may reduce $\frac{1}{2}$ and $\frac{1}{3}$ to 12ths; $\frac{1}{2} = \frac{6}{12}$; $\frac{1}{3} = \frac{4}{12}$.

231. Change $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having the *least* common denominator.

SOLUTION. — The *least* common denominator must be the *least* common multiple of 2 and 3, which is 6. $\frac{1}{2} = \frac{3}{6}$; $\frac{1}{3} = \frac{2}{6}$.

Change to fractions having a common denominator:

232. $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}$	236. $\frac{2}{4}, \frac{1}{3}, \frac{2}{5}$	240. $\frac{1}{9}, \frac{1}{8}, \frac{1}{18}$
233. $\frac{2}{3}, \frac{3}{4}, \frac{1}{12}$	237. $\frac{1}{7}, \frac{2}{14}, \frac{5}{28}$	241. $\frac{8}{9}, \frac{1}{10}, \frac{2}{20}$
234. $\frac{5}{6}, \frac{1}{12}, \frac{3}{24}$	238. $\frac{4}{9}, \frac{1}{18}, \frac{2}{36}$	242. $\frac{1}{9}, \frac{2}{18}, \frac{8}{36}$
235. $\frac{1}{7}, \frac{1}{3}, \frac{1}{2}$	239. $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}$	243. $\frac{1}{4}, \frac{1}{6}, \frac{2}{3}$

Change to fractions having the *least* common denominator :

244. $\frac{1}{3}, \frac{1}{5}, \frac{1}{6}$	248. $\frac{1}{3}, \frac{1}{7}, \frac{5}{8}$	252. $\frac{2}{7}, \frac{3}{8}, \frac{1}{14}$
245. $\frac{2}{4}, \frac{5}{8}, \frac{7}{8}$	249. $\frac{1}{9}, \frac{1}{3}, \frac{1}{6}$	253. $1\frac{2}{3}, \frac{1}{9}, \frac{1}{18}$
246. $\frac{1}{4}, \frac{1}{2}, \frac{1}{8}$	250. $\frac{2}{9}, \frac{1}{18}, \frac{1}{3}$	254. $2\frac{1}{6}, \frac{1}{3}, 3\frac{1}{3}$
247. $\frac{6}{8}, \frac{2}{3}, \frac{7}{10}$	251. $\frac{3}{5}, \frac{2}{7}, \frac{1}{4}$	255. $5\frac{1}{2}, \frac{1}{10}, \frac{2}{3}$

253. Find the sum of $\frac{1}{6} + \frac{5}{6} + \frac{1}{6}$.

SOLUTION. — 1 sixth + 5 sixths + 1 sixth = 10 sixths = $\frac{10}{6}$
 $= 1\frac{2}{3} = 1\frac{4}{6}$.

Find the sums of:

- | | | |
|--|---|--|
| 257. $\frac{1}{9} + \frac{2}{9} + \frac{3}{9}$ | 261. $\frac{1}{7} + \frac{5}{7} + \frac{3}{7}$ | 265. $\frac{1}{4} + \frac{3}{4} + \frac{5}{4}$ |
| 258. $\frac{1}{3} + \frac{2}{3} + \frac{1}{3}$ | 262. $\frac{1}{6} + \frac{5}{6} + \frac{1}{6}$ | 266. $\frac{1}{5} + \frac{2}{5} + \frac{3}{5} + \frac{1}{5}$ |
| 259. $\frac{2}{7} + \frac{2}{7} + \frac{1}{7}$ | 263. $\frac{1}{10} + \frac{3}{10} + \frac{5}{10}$ | 267. $\frac{1}{8} + \frac{3}{8} + \frac{3}{8} + \frac{5}{8}$ |
| 260. $\frac{1}{8} + \frac{2}{8} + \frac{3}{8}$ | 264. $\frac{1}{4} + \frac{3}{4} + \frac{2}{4}$ | 268. $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$ |

269. Find the sums of $\frac{1}{3}$ and $\frac{2}{4}$.

SOLUTION. — Fractions can only be added when they have like denominators. Therefore we must change $\frac{1}{3}$ and $\frac{2}{4}$ to fractions having their least common denominator.

$$\frac{1}{3} = \frac{2}{6}; \quad \frac{2}{4} = \frac{3}{6}; \quad \frac{2}{6} + \frac{3}{6} = \frac{5}{6} = 1\frac{1}{6}.$$

Find the sums of:

- | | | |
|--|---|--|
| 270. $\frac{7}{12} + \frac{3}{10}$ | 278. $\frac{9}{20} + \frac{7}{10} + \frac{3}{5}$ | 286. $\frac{2}{9} + \frac{3}{9} + \frac{2}{9}$ |
| 271. $\frac{3}{4} + \frac{5}{6}$ | 279. $\frac{5}{6} + \frac{1}{12} + \frac{2}{3}$ | 287. $\frac{1}{8} + \frac{5}{8} + \frac{3}{8}$ |
| 272. $\frac{5}{7} + \frac{1}{6}$ | 280. $\frac{4}{5} + \frac{3}{20} + \frac{3}{10}$ | 288. $\frac{7}{18} + \frac{4}{9} + \frac{5}{6} + \frac{1}{3}$ |
| 273. $\frac{3}{8} + \frac{1}{16}$ | 281. $\frac{1}{8} + \frac{3}{4} + \frac{5}{8}$ | 289. $\frac{5}{12} + \frac{4}{3} + \frac{3}{4} + \frac{1}{3}$ |
| 274. $\frac{4}{5} + \frac{3}{20}$ | 282. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$ | 290. $\frac{4}{5} + \frac{1}{5} + \frac{2}{15} + \frac{1}{3}$ |
| 275. $\frac{2}{3} + \frac{1}{12}$ | 283. $\frac{6}{7} + \frac{1}{8} + \frac{3}{4}$ | 291. $\frac{5}{6} + \frac{1}{4} + \frac{1}{3} + \frac{1}{6}$ |
| 276. $\frac{2}{3} + \frac{4}{6} + \frac{1}{3}$ | 284. $\frac{7}{30} + \frac{9}{10} + \frac{4}{5}$ | 292. $\frac{2}{3} + \frac{3}{4} + \frac{1}{2} + \frac{1}{6}$ |
| 277. $\frac{7}{8} + \frac{4}{8} + \frac{5}{8}$ | 285. $\frac{6}{17} + \frac{3}{84} + \frac{5}{24}$ | 293. $\frac{1}{9} + \frac{5}{18} + \frac{2}{3} + \frac{1}{36}$ |

294. Find the sum of $\frac{4}{16} + \frac{3}{8} + \frac{3}{24} + \frac{6}{36}$.

SOLUTION. — We may reduce the fractions to their lowest terms before adding. $\frac{4}{16} = \frac{1}{4}$; $\frac{3}{8} = \frac{3}{8}$; $\frac{3}{24} = \frac{1}{8}$; $\frac{6}{36} = \frac{1}{6}$; then $\frac{1}{4} + \frac{3}{8} + \frac{1}{8} + \frac{1}{6}$
 $= \frac{3}{12} + \frac{4.5}{12} + \frac{1.5}{12} + \frac{2}{12} = \frac{9}{12} = \frac{3}{4}$, which reduced to its lowest terms = $\frac{3}{4}$.

Add:

295. $\frac{7}{49} + \frac{2}{28} + \frac{3}{21}$ 298. $\frac{3}{10} + \frac{6}{60} + \frac{7}{70}$ 301. $\frac{6}{24} + \frac{4}{20} + \frac{8}{32}$
 296. $\frac{9}{36} + \frac{10}{30} + \frac{2}{12}$ 299. $\frac{9}{81} + \frac{3}{27} + \frac{4}{36}$ 302. $\frac{7}{49} + \frac{3}{21} + \frac{8}{48}$
 297. $\frac{8}{24} + \frac{9}{32} + \frac{1}{16}$ 300. $\frac{8}{64} + \frac{9}{24} + \frac{4}{32}$ 303. $\frac{1}{18} + \frac{1}{18} + \frac{9}{27}$

304. Find the sum of $\frac{1}{8}$, $2\frac{1}{2}$, and $3\frac{1}{8}$.SOLUTION. — $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{3}{8}$; $\frac{3}{8} + \frac{1}{2} + \frac{3}{4} = 2\frac{3}{8}$; $2 + 3 = 5$; $5 + 2\frac{3}{8} = 7\frac{3}{8}$.

Find the sums of:

305. $2\frac{1}{2} + 3\frac{1}{8}$ 313. $5\frac{1}{2} + 9 + 6\frac{1}{8}$
 306. $8\frac{3}{4} + 12\frac{1}{8}$ 314. $3\frac{3}{4} + 2\frac{1}{8} + 4$
 307. $9\frac{1}{8} + 3\frac{3}{4}$ 315. $25\frac{1}{8} + 13\frac{3}{8} + 5\frac{7}{8}$
 308. $6\frac{2}{8} + 5\frac{1}{8}$ 316. $\frac{9}{10} + 11\frac{1}{2} + 10\frac{1}{5}$
 309. $9\frac{1}{8} + 13\frac{1}{16}$ 317. $8 + 3 + 2\frac{1}{4}$
 310. $14\frac{1}{5} + 10\frac{5}{6} + 5\frac{1}{2}$ 318. $7\frac{5}{8} + 4\frac{1}{2} + \frac{1}{2}$
 311. $7\frac{3}{12} + 15\frac{5}{8} + 10\frac{1}{4}$ 319. $19 + 10\frac{3}{4} + 11$
 312. $6\frac{1}{8} + 7\frac{1}{2} + 17\frac{1}{4}$ 320. $3\frac{1}{8} + 2\frac{6}{16} + 1\frac{5}{8}$

Add:

321. $\frac{1}{4} + \frac{3}{16} + \frac{4}{8}$ 324. $\frac{9}{11} + \frac{4}{7} + \frac{1}{2}$
 322. $\frac{1}{9} + \frac{2}{6} + \frac{3}{6}$ 325. $\frac{3}{8} + \frac{6}{16} + \frac{5}{4}$
 323. $\frac{3}{11} + \frac{4}{4} + \frac{6}{8}$ 326. $\frac{5}{8} + \frac{4}{16} + \frac{2}{4}$

327. Find the difference between $\frac{7}{8}$ and $\frac{3}{8}$.SOLUTION. — 7 eighths — 3 eighths = 4 eighths = $\frac{1}{2}$.

Find the differences between:

328. $\frac{2}{8}$ and $\frac{1}{8}$ 332. $\frac{5}{7}$ and $\frac{5}{7}$ 336. $\frac{3}{8}$ and $\frac{2}{8}$
 329. $\frac{3}{4}$ and $\frac{2}{4}$ 333. $\frac{1}{8}$ and $\frac{3}{8}$ 337. $\frac{3}{9}$ and $\frac{6}{9}$
 330. $\frac{5}{8}$ and $\frac{1}{8}$ 334. $\frac{3}{9}$ and $\frac{3}{9}$ 338. $\frac{3}{25}$ and $\frac{6}{25}$
 331. $\frac{5}{8}$ and $\frac{4}{8}$ 335. $\frac{4}{17}$ and $\frac{2}{17}$ 339. $\frac{3}{87}$ and $\frac{6}{87}$

Find the remainders :

340. $\frac{8}{85} - \frac{2}{85}$

341. $\frac{4}{82} - \frac{8}{82}$

342. $\frac{9}{87} - \frac{2}{87}$

343. Find the difference between $\frac{3}{4}$ and $\frac{2}{3}$.

SOLUTION. — Fractions must have like denominators before they can be subtracted. $\frac{3}{4} = \frac{9}{12}$; $\frac{2}{3} = \frac{8}{12}$; $\frac{9}{12} - \frac{8}{12} = \frac{1}{12}$.

Find the differences between :

344. $\frac{5}{7}$ and $\frac{3}{8}$

347. $\frac{1}{2}$ and $\frac{3}{4}$

350. $\frac{1}{2}$ and $\frac{1}{7}$

345. $\frac{1}{4}$ and $\frac{1}{5}$

348. $\frac{5}{8}$ and $\frac{1}{2}$

351. $\frac{1}{3}$ and $\frac{1}{4}$

346. $\frac{9}{10}$ and $\frac{2}{3}$

349. $\frac{5}{8}$ and $\frac{1}{3}$

352. $\frac{1}{4}$ and $\frac{3}{8}$

Subtract :

353. $\frac{1}{3}$ from $\frac{1}{2}$

355. $\frac{2}{3}$ from $\frac{4}{5}$

357. $\frac{1}{5}$ from $\frac{4}{7}$

354. $\frac{1}{4}$ from $\frac{1}{3}$

356. $\frac{2}{5}$ from $\frac{5}{8}$

358. $\frac{1}{3}$ from $\frac{3}{16}$

359. From $4\frac{2}{3}$ take $2\frac{1}{5}$.

SOLUTION. — $\frac{2}{3} = \frac{10}{15}$; $\frac{1}{5} = \frac{3}{15}$; $\frac{10}{15} - \frac{3}{15} = \frac{7}{15}$; $4 - 2 = 2$; $2 + \frac{7}{15} = 2\frac{7}{15}$.

Find the remainders :

360. $12\frac{9}{10} - 6\frac{1}{10}$

363. $28\frac{5}{8} - 17\frac{3}{8}$

366. $15\frac{3}{4} - 4\frac{1}{4}$

361. $36\frac{1}{2} - 24\frac{1}{2}$

364. $15\frac{4}{5} - 10\frac{2}{5}$

367. $12\frac{1}{4} - 2\frac{1}{4}$

362. $16\frac{3}{4} - 9\frac{1}{4}$

365. $14\frac{1}{2} - 13\frac{1}{8}$

368. $13\frac{1}{4} - 4\frac{1}{4}$

369. From 13 take $3\frac{1}{2}$.

SOLUTION. — If we reduce 1 of the 13 units to thirds the problem is: from $12\frac{2}{3}$ take $3\frac{1}{2}$; $\frac{2}{3} - \frac{1}{2} = \frac{1}{6}$; $12 - 3 = 9$; $9 + \frac{1}{6} = 9\frac{1}{6}$.

370. From $15\frac{1}{3}$ take $13\frac{1}{2}$.

SOLUTION. — Since $\frac{1}{3}$ cannot be taken from $\frac{1}{2}$ we change one of the 15 units to thirds, making $14\frac{2}{3}$; then we have $14\frac{2}{3} - 13\frac{1}{2} = 1\frac{1}{6}$.

371. From $12\frac{1}{2}$ take $2\frac{3}{8}$

374. From 7 take $3\frac{1}{2}$

372. From $15\frac{3}{4}$ take $3\frac{3}{4}$

375. From 9 take $4\frac{1}{2}$

373. From $25\frac{5}{8}$ take $5\frac{7}{8}$

376. From 16 take $15\frac{1}{4}$

377. From $30\frac{1}{2}$ take $20\frac{1}{2} + 3\frac{7}{12}$.
 378. From $40 - 10\frac{2}{3}$ take $7\frac{1}{2} + 5\frac{1}{8}$.
 379. From $28\frac{1}{3}$ take $21\frac{1}{3} - 5\frac{1}{3}$.
 380. From $\frac{3}{8} + \frac{1}{2} + \frac{2}{3}$ take $\frac{1}{4} + \frac{2}{3} + \frac{3}{12}$.
 381. From $3 + \frac{5}{7} + \frac{2}{3}$ take $1\frac{7}{11}$.
 382. From $17\frac{3}{4}$ take $5 + 6\frac{1}{8}$.
 383. From $25\frac{1}{2}$ take $11\frac{1}{2} + 7\frac{3}{8}$.
 384. From $9 + 12\frac{5}{7}$ take $8\frac{2}{3} + 4\frac{1}{7}$.
 385. From $3 + 6\frac{1}{2}$ take $7\frac{1}{2} + 1\frac{1}{8}$.

Find the values of:

386. $\frac{5}{25} - \frac{1}{8} + \frac{7}{49} + \frac{2}{14}$ 390. $7 + \frac{1}{3} - \frac{1}{4} + 3\frac{1}{2}$
 387. $2\frac{2}{3} + 6\frac{5}{10} - 2\frac{3}{5} - 1\frac{1}{2}$ 391. $8\frac{1}{2} - 1\frac{1}{6} + 9 - 5$
 388. $1\frac{1}{8} + 3\frac{1}{2} + 7\frac{1}{8} - 6$ 392. $17\frac{3}{4} - 1\frac{1}{2} - 2\frac{1}{8} - 3\frac{1}{8}$
 389. $9 - \frac{1}{6} - \frac{1}{3} + 3$ 393. $18\frac{1}{8} - 3\frac{1}{8} + 2\frac{1}{9} - 10\frac{3}{8}$
 394. What is the difference between $17\frac{3}{4}$ and $5 + 6\frac{1}{8}$?
 395. What is the difference between $25\frac{1}{2}$ and $11\frac{1}{2} + 7\frac{3}{8}$?
 396. What is the difference between $13\frac{1}{2}$ and $5 + 6\frac{1}{8}$?
 397. What is the difference between $21\frac{1}{2}$ and $7 - 2\frac{1}{2}$?
 398. What is the difference between $36\frac{1}{2}$ and $5\frac{1}{8} + 2$?
 399. What is the difference between $60 + 8\frac{5}{12}$ and $13\frac{1}{4} + 1\frac{1}{8}$?
 400. What is the difference between $19\frac{1}{8} - 3\frac{1}{8}$ and $25\frac{5}{12} + 3\frac{1}{12}$?
 401. What is the difference between $9 + 12\frac{5}{7}$ and $8\frac{2}{3} + 4\frac{1}{7}$?

402. How much is $3 \times \frac{2}{7}$?

SOLUTION.—Since $3 \times 2 = 6$, 3×2 sevenths = 6 sevenths, or $\frac{6}{7}$.

Find the products of:

403. $2 \times \frac{3}{8}$

408. $8 \times \frac{1}{4}$

413. $8 \times \frac{1}{11}$

404. $5 \times \frac{4}{3}$

409. $6 \times \frac{1}{3}$

414. $4 \times \frac{1}{10}$

405. $3 \times \frac{1}{2}$

410. $4 \times \frac{1}{7}$

415. $\frac{1}{3} \times 8$

406. $7 \times \frac{1}{3}$

411. $7 \times \frac{1}{3}$

416. $\frac{1}{3} \times 7$

407. $9 \times \frac{2}{7}$

412. $9 \times \frac{1}{12}$

417. $\frac{1}{7} \times 6$

418. How much is $4 \times \frac{3}{16}$?

SOLUTION.— $4 \times \frac{3}{16} = \frac{12}{16} = \frac{3}{4}$.

Or, since a numerator is a dividend and a denominator a divisor, and since the same result is obtained by dividing the divisor as by multiplying the dividend by the same number, we may divide 16 by 4, and the direct result is $\frac{3}{4}$ in its lowest terms.

Find the products of:

419. $\frac{2}{3}$ by 3

430. $\frac{3}{8} \times 11$

441. $15 \times \frac{4}{5}$

420. $\frac{5}{6}$ by 6

431. $\frac{7}{8} \times 6$

442. $19 \times \frac{9}{19}$

421. $\frac{2}{3}$ by 9

432. $\frac{3}{8} \times 9$

443. $54 \times \frac{6}{6}$

422. $\frac{3}{4}$ by 4

433. $3 \times \frac{7}{3}$

444. $81 \times \frac{2}{27}$

423. $\frac{2}{3}$ by 8

434. $5 \times \frac{6}{15}$

445. $64 \times \frac{5}{16}$

424. $\frac{4}{16}$ by 8

435. $4 \times \frac{3}{16}$

446. $14 \times \frac{3}{14}$

425. $\frac{5}{25}$ by 5

436. $5 \times \frac{1}{5}$

447. $3 \times \frac{2}{3}$

426. $\frac{1}{3}$ by 9

437. $4 \times \frac{3}{7}$

448. $9 \times \frac{8}{81}$

427. $\frac{2}{12} \times 6$

438. $15 \times \frac{7}{15}$

449. $\frac{7}{49} \times 7$

428. $\frac{5}{14} \times 7$

439. $14 \times \frac{3}{7}$

450. $4 \times \frac{1}{6}$

429. $\frac{9}{36} \times 4$

440. $8 \times \frac{3}{4}$

451. $\frac{3}{11} \times 11$

452. Multiply $3\frac{3}{8}$ by 5.

SOLUTION. — $5 \times 3 = 15$; $5 \times \frac{3}{8} = \frac{15}{8} = 1\frac{7}{8}$; $15 + 1\frac{7}{8} = 16\frac{7}{8}$.

Or, $3\frac{3}{8} = \frac{27}{8}$; $5 \times \frac{27}{8} = \frac{135}{8} = 16\frac{7}{8}$.

Multiply :

453. $6\frac{1}{2}$ by 12

456. $8\frac{3}{8}$ by 6

459. 4 by $6\frac{1}{3}$

454. $5\frac{5}{8}$ by 4

457. $5\frac{7}{8}$ by 7

460. 5 by $4\frac{1}{2}$

455. $7\frac{1}{2}$ by 3

458. $8\frac{3}{4}$ by 4

461. 3 by $8\frac{3}{4}$

462. How much is $\frac{3}{4}$ of 13?

SOLUTION. — $\frac{1}{4}$ of 13 is the same as $\frac{1}{4} \times 13$ or $13 \times \frac{1}{4}$; hence $\frac{3}{4}$ of 13 = $\frac{39}{4} = 9\frac{3}{4}$.

Find the results :

463. $\frac{3}{7}$ of 16

466. $\frac{2}{5}$ of 16

469. $\frac{3}{7}$ of 21

464. $\frac{1}{3}$ of 49

467. $\frac{1}{3}$ of 40

470. $\frac{2}{5}$ of 20

465. $\frac{5}{16}$ of 28

468. $\frac{2}{25}$ of 50

471. $\frac{5}{8}$ of 48

472. How much is $\frac{3}{4}$ of $\frac{1}{2}$?

SOLUTION. — 1 seventh of $\frac{1}{2} = \frac{1}{14}$; 3 sevenths of $\frac{1}{2} = 3 \times \frac{1}{14} = \frac{3}{14}$. That is, we multiply the numerators and denominators together when we multiply a fraction by a fraction.

Find the products :

473. $\frac{1}{2}$ of $\frac{1}{4}$

476. $\frac{7}{8}$ of $\frac{1}{11}$

479. $\frac{1}{3}$ of $\frac{3}{7}$

474. $\frac{2}{4}$ of $\frac{1}{3}$

477. $\frac{2}{5}$ of $\frac{1}{3}$

480. $\frac{5}{18}$ of $\frac{1}{2}$

475. $\frac{3}{8}$ of $\frac{1}{15}$

478. $\frac{3}{8}$ of $\frac{5}{7}$

481. $\frac{1}{4}$ of $\frac{5}{8}$

482. Find the product of $\frac{3}{4} \times \frac{8}{9}$.

SOLUTION. — Since $\frac{3}{4} \times \frac{8}{9} = \frac{3 \times 8}{4 \times 9}$, we may cancel the like fractions in dividend and divisor; thus, $\frac{\overset{2}{\cancel{3}} \times \overset{2}{\cancel{8}}}{\cancel{4} \times \underset{3}{\cancel{9}}}$, and the result is $\frac{2}{3}$.

Find the products of:

483. $\frac{2}{3} \times \frac{1}{2}$

488. $\frac{3}{4} \times \frac{5}{12}$

493. $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5}$

484. $\frac{3}{8} \times \frac{4}{15}$

489. $\frac{9}{16} \times \frac{8}{3}$

494. $\frac{1}{4} \times \frac{3}{8} \times \frac{3}{4}$

485. $\frac{5}{12} \times \frac{2}{3}$

490. $\frac{1}{5} \times \frac{1}{5}$

495. $\frac{2}{3} \times \frac{6}{12} \times \frac{4}{15}$

486. $\frac{9}{81} \times \frac{3}{27}$

491. $\frac{8}{48} \times \frac{1}{2}$

496. $\frac{5}{8} \times \frac{6}{8} \times \frac{8}{8}$

487. $\frac{4}{17} \times \frac{6}{18}$

492. $\frac{7}{7} \times \frac{1}{20}$

497. $\frac{3}{8} \times \frac{10}{9} \times \frac{8}{80}$

498. Find $\frac{3}{4}$ of $6\frac{1}{3}$.

SOLUTION. — $6\frac{1}{3}$ reduced to a mixed number = $4\frac{1}{3}$; $\frac{3}{4}$ of $4\frac{1}{3}$ = $4\frac{1}{4}$.

Find the values of:

499. $\frac{3}{4} \times 1\frac{1}{2}$

503. $\frac{1}{8} \times 9\frac{3}{5}$

507. $3\frac{3}{7} \times 35$

500. $\frac{1}{3} \times 3\frac{1}{6}$

504. $\frac{1}{4} \times 2\frac{1}{2}$

508. $7\frac{1}{4} \times 32$

501. $\frac{1}{8} \times 4\frac{1}{2}$

505. $8\frac{3}{4} \times 16$

509. $5\frac{7}{8} \times 45$

502. $\frac{1}{5} \times 3\frac{1}{4}$

506. $9\frac{1}{8} \times 24$

510. $8\frac{6}{7} \times 49$

511. Find the value of $3\frac{1}{8} \times 1\frac{1}{2}$.

SOLUTION. — Changing both numbers to improper fractions, we have $\frac{25}{8} \times \frac{3}{2} = 5$.

Find the values of:

512. $1\frac{1}{4} \times 1\frac{1}{8}$

515. $8\frac{3}{4} \times 2\frac{1}{2}$

518. $6\frac{3}{4} \times 2\frac{1}{8}$

513. $2\frac{3}{8} \times 1\frac{6}{8}$

516. $7\frac{1}{2} \times 3\frac{1}{8}$

519. $1\frac{1}{17} \times 5\frac{1}{8}$

514. $3\frac{1}{4} \times 1\frac{1}{15}$

517. $4\frac{1}{8} \times 1\frac{1}{10}$

520. $3\frac{1}{8} \times 1\frac{1}{4}$

521. What is the product of $4\frac{1}{8}$ times 9 multiplied by 3?

522. What is the product of 5 times $3\frac{1}{8}$ multiplied by $2\frac{1}{4}$?

523. Multiply $4\frac{1}{2}$ times 10 by $\frac{2}{3}$ of 15.
 524. Multiply $3\frac{1}{2}$ times $\frac{1}{2}$ by $\frac{1}{3}$ of 24.
 525. Multiply $4\frac{3}{4}$ by $\frac{3}{4}$ of 16.
 526. Multiply 2 times $9\frac{1}{2}$ by $2\frac{1}{2}$ times 4.
 527. Multiply 5 times $3\frac{3}{4}$ by $\frac{1}{2}$ of 15.
 528. What is the sum of 8 times $7\frac{3}{4}$, and $4\frac{1}{2}$ times 10 ?
 529. What is the sum of $6\frac{3}{4}$ times 11, and 12 times $5\frac{1}{4}$?
 530. What is the difference between $4\frac{3}{4}$ times 12, and 3 times $9\frac{3}{4}$?
 531. What is the difference between 3 times $8\frac{1}{2}$, and $10\frac{1}{2}$ times 4 ?
 532. How much is $12\frac{3}{4}$ times 7 ? $9\frac{3}{4}$ times 9 ?
 533. How much is $5\frac{3}{4}$ times 15 ? $3\frac{1}{4}$ times 40 ?
 534. What is the product of $\frac{1}{2}$ of $\frac{3}{4}$ of 16 multiplied by $5\frac{1}{2}$?
 535. What is the value of $\frac{3}{4}$ of $\frac{1}{2}$ of $6\frac{3}{4}$?
 536. What is the value of $\frac{1}{2}$ of $\frac{3}{4}$ of 30 ?
 537. What is the value of $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{1}{2}$?
 538. What is $1\frac{3}{5}$ times $\frac{5}{8}$? $4\frac{1}{2}$ times $\frac{9}{8}$?
 539. What is $10\frac{1}{2}$ times $2\frac{3}{4}$? $2\frac{1}{2}$ times $25\frac{1}{2}$?
 540. Divide $\frac{1}{5}$ by 2.

SOLUTION. — 4 fifths divided by 2 = 2 fifths or $\frac{2}{5}$. A fraction is divided by an integer by *dividing its numerator* by that integer.

Divide :

- | | | |
|--------------------------|--------------------------|----------------------------|
| 541. $\frac{2}{3}$ by 3 | 546. $\frac{6}{11}$ by 2 | 551. $\frac{11}{12}$ by 5 |
| 542. $\frac{3}{4}$ by 3 | 547. $\frac{3}{8}$ by 3 | 552. $\frac{9}{17}$ by 3 |
| 543. $\frac{4}{12}$ by 4 | 548. $\frac{4}{8}$ by 2 | 553. $\frac{4}{8}$ by 2 |
| 544. $\frac{5}{8}$ by 5 | 549. $\frac{9}{7}$ by 9 | 554. $\frac{10}{8}$ by 2 |
| 545. $\frac{1}{2}$ by 4 | 550. $\frac{1}{3}$ by 6 | 555. $\frac{11}{12}$ by 11 |

556. Divide $\frac{3}{4}$ by 2.

SOLUTION.—When we divide a number by 2, we take $\frac{1}{2}$ of it. $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$. Therefore we may divide a fraction by an integer by *multiplying its denominator* by the integer.

Divide :

557. $\frac{7}{8}$ by 3

562. $\frac{1}{16}$ by 12

567. $\frac{2}{11}$ by 5

558. $\frac{4}{5}$ by 6

563. $\frac{2}{35}$ by 9

568. $\frac{7}{16}$ by 6

559. $\frac{3}{7}$ by 9

564. $\frac{2}{17}$ by 4

569. $\frac{1}{12}$ by 7

560. $\frac{2}{3}$ by 10

565. $\frac{4}{7}$ by 3

570. $\frac{5}{8}$ by 9

561. $\frac{1}{8}$ by 11

566. $\frac{3}{8}$ by 4

571. $\frac{4}{7}$ by 10

572. Divide $11\frac{1}{2}$ by 4.

SOLUTION.— $11\frac{1}{2} = 2\frac{3}{2}$; $2\frac{3}{2} \div 4 = \frac{1}{4}$ of $2\frac{3}{2} = 2\frac{3}{8} = 2\frac{7}{8}$.

Divide :

573. $2\frac{2}{3}$ by 3

576. $5\frac{1}{6}$ by 2

579. $10\frac{2}{15}$ by 9

574. $5\frac{1}{6}$ by 2

577. $4\frac{1}{3}$ by 3

580. $11\frac{2}{3}$ by 7

575. $3\frac{1}{4}$ by 4

578. $8\frac{1}{2}$ by 7

581. $13\frac{1}{4}$ by 8

582. Divide 3 by $\frac{1}{4}$.

SOLUTION.—Since $\frac{1}{4}$ is contained 4 times in 1, it is contained 3×4 or 12 times in 3.

583. Divide 3 by $\frac{3}{4}$.

SOLUTION.—Since $\frac{1}{4}$ is contained 12 times in 3, $\frac{3}{4}$ is contained $\frac{1}{3}$ of 12 times, or 4 times in 3.

To divide an integer by a fraction, we multiply it by the denominator and divide by the numerator, or we multiply it by the fraction with its terms inverted; thus, $3 \div \frac{3}{4} = 3 \times \frac{4}{3} = 4$.

Cancellation should be used when possible.

Divide :

584. 5 by $\frac{1}{4}$

589. 10 by $\frac{5}{7}$

594. 25 by $\frac{5}{8}$

585. 6 by $\frac{3}{7}$

590. 11 by $\frac{1}{18}$

595. 75 by $\frac{3}{5}$

586. 7 by $\frac{3}{8}$

591. 12 by $\frac{4}{9}$

596. 36 by $\frac{7}{8}$

587. 8 by $\frac{4}{7}$

592. 15 by $\frac{5}{7}$

597. 14 by $\frac{7}{8}$

588. 9 by $\frac{3}{8}$

593. 16 by $\frac{4}{9}$

598. 25 by $\frac{5}{10}$

599. Divide 4 by $2\frac{2}{3}$.

SOLUTION. — $2\frac{2}{3} = \frac{12}{6}$; $4 \div \frac{12}{6} = 4 \times \frac{6}{12} = \frac{5}{3} = 1\frac{2}{3}$.

Divide :

600. 23 by $4\frac{3}{4}$

603. 46 by $7\frac{2}{3}$

606. 15 by $3\frac{1}{2}$

601. 50 by $3\frac{1}{2}$

604. 11 by $1\frac{5}{8}$

607. 17 by $5\frac{3}{8}$

602. 62 by $5\frac{1}{4}$

605. 13 by $2\frac{1}{8}$

608. 16 by $3\frac{1}{4}$

609. Divide $\frac{3}{4}$ by $\frac{2}{3}$.

SOLUTION. — $3 \div \frac{2}{3} = \frac{9}{2}$; since $\frac{3}{4}$ is $\frac{1}{4}$ of 3, $\frac{3}{4} \div \frac{2}{3} = \frac{1}{4}$ of $\frac{9}{2} = \frac{9}{8} = 1\frac{1}{8}$.

Or, $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$.

That is, a fraction is divided by a fraction when we multiply the dividend by the divisor inverted.

Divide :

610. $\frac{1}{4}$ by $\frac{1}{2}$

615. $\frac{5}{8}$ by $\frac{7}{8}$

620. $\frac{5}{12}$ by $\frac{1}{3}$

611. $\frac{1}{8}$ by $\frac{1}{3}$

616. $\frac{3}{8}$ by $\frac{5}{7}$

621. $\frac{7}{15}$ by $\frac{3}{8}$

612. $\frac{1}{9}$ by $\frac{1}{6}$

617. $\frac{4}{9}$ by $\frac{7}{8}$

622. $1\frac{1}{2}$ by $1\frac{1}{4}$

613. $1\frac{1}{5}$ by $\frac{1}{4}$

618. $1\frac{3}{10}$ by $1\frac{2}{5}$

623. $2\frac{1}{2}$ by $3\frac{1}{4}$

614. $\frac{3}{4}$ by $\frac{1}{8}$

619. $1\frac{6}{15}$ by $\frac{3}{4}$

624. $7\frac{1}{8}$ by $5\frac{1}{2}$

Divide:

625. $\frac{3}{4}$ of 21 by $\frac{2}{3}$ of 10 627. $\frac{7}{8}$ of 24 by $\frac{1}{3}$ of 63

626. $\frac{2}{3}$ of 15 by $\frac{1}{2}$ of 20 628. $\frac{3}{4}$ of 24 by $\frac{1}{8}$ of 48

629. What part of 4 is 3?

SOLUTION. — 1 is $\frac{1}{4}$ of 4; 3 is 3 times $\frac{1}{4}$, or $\frac{3}{4}$, of 4.

What part of

630. 5 is 1? 2? 3? 4? 634. 9 is 2? 3? 5? 7?

631. 6 is 3? 4? 5? 2? 635. 10 is 5? 6? 8? 9?

632. 7 is 2? 3? 4? 5? 636. 11 is 3? 4? 6? 8?

633. 8 is 2? 4? 5? 6? 637. 12 is 5? 7? 8? 9?

638. 9 is $\frac{1}{5}$ of what number?

SOLUTION. — 9 is $\frac{1}{5}$ of 5 times 9, or 45.

639. 8 is $\frac{1}{3}$ of what number? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{7}$?

640. 7 is $\frac{1}{6}$ of what number? $\frac{1}{8}$? $\frac{1}{10}$? $\frac{1}{12}$?

641. 6 is $\frac{1}{9}$ of what number? $\frac{1}{12}$? $\frac{1}{15}$? $\frac{1}{18}$?

642. 10 is $\frac{1}{10}$ of what number? $\frac{1}{11}$? $\frac{1}{12}$? $\frac{1}{13}$? $\frac{1}{14}$?

643. 6 is $\frac{2}{3}$ of what number?

SOLUTION. — If 6 is 2 thirds of some number, 1 third of the number is $\frac{1}{2}$ of 6, or 3; and 3 thirds, or the whole number, is 3 times 3, or 9.

644. 25 is $\frac{5}{8}$ of what number?

645. 14 is $\frac{7}{12}$ of what number?

646. 9 is $\frac{3}{10}$ of what number?

647. 12 is $\frac{4}{15}$ of what number?

648. 18 is $\frac{6}{11}$ of what number?

649. 72 is $\frac{8}{9}$ of what number?

650. 40 is $\frac{10}{11}$ of what number?

651. 36 is $\frac{12}{10}$ of what number?

652. 42 is $\frac{7}{5}$ of what number?

653. $\frac{5}{8}$ of 24 is $\frac{2}{3}$ of what number ?

SOLUTION. — $\frac{5}{8}$ of 24 = 20. If 20 is $\frac{2}{3}$ of a number, $\frac{1}{3}$ of the number is $\frac{1}{3}$ of 20, or 10, and $\frac{2}{3}$, or the number, is 3×10 , or 30.

654. $\frac{3}{4}$ of 16 is $\frac{9}{7}$ of what number ?

655. $\frac{4}{5}$ of 30 is $\frac{8}{11}$ of what number ?

656. $\frac{2}{3}$ of 28 is $\frac{7}{9}$ of what number ?

657. $\frac{3}{5}$ of 18 is $\frac{1}{4}$ of what number ?

658. $\frac{6}{10}$ of 100 is $\frac{5}{12}$ of what number ?

659. $\frac{3}{20}$ of 80 is $\frac{2}{15}$ of what number ?

660. $\frac{3}{8}$ of 64 is $\frac{8}{9}$ of what number ?

661. $\frac{4}{5}$ is $\frac{2}{3}$ of what number ?

SOLUTION. — If $\frac{4}{5}$ is 2 thirds of a number, 1 third of the number is $\frac{1}{3}$ of $\frac{4}{5}$, or $\frac{2}{3}$; and 3 thirds, or the whole number, is 3 times $\frac{2}{3}$, which is $\frac{8}{5}$, or $\frac{2}{3}$.

662. $\frac{3}{7}$ is $\frac{3}{8}$ of what number ?

663. $\frac{8}{9}$ is $\frac{4}{7}$ of what number ?

664. $\frac{2}{15}$ is $\frac{2}{5}$ of what number ?

665. $\frac{3}{4}$ is $\frac{9}{7}$ of what number ?

666. $\frac{4}{5}$ is $\frac{4}{3}$ of what number ?

667. 18 is $\frac{3}{8}$ of how many times 6 ?

SOLUTION. — 18 is $\frac{3}{8}$ of 30; 30 is 5 times 6. Therefore 18 is $\frac{3}{8}$ of 5 times 6.

668. 25 is $\frac{5}{8}$ of how many times 15 ?

669. 36 is $\frac{3}{8}$ of how many times 4 ?

670. 28 is $\frac{7}{15}$ of how many times 8 ?

671. 40 is $\frac{5}{12}$ of how many times 16 ?

672. 75 is $\frac{3}{4}$ of how many times 20 ?

673. 64 is $\frac{8}{9}$ of how many times 24 ?

674. 48 is $\frac{1}{2} \times \frac{6}{8}$ of how many times $\frac{1}{3}$ of 36 ?

675. 35 is $\frac{7}{4}$ of how many times $\frac{1}{7}$ of 28 ?

676. 42 is $\frac{6}{11}$ of how many times $\frac{1}{3}$ of 63 ?

677. 84 is $\frac{1}{7} \times 2$ of how many times $\frac{1}{3}$ of 35 ?

678. 27 is $\frac{9}{8}$ of how many times $\frac{1}{3}$ of 72 ?

679. 36 is $\frac{4}{3}$ of how many times $\frac{1}{3}$ of 27 ?

680. $19\frac{1}{2}$ is $\frac{4}{5}$ of how many times $\frac{1}{4}$ of 20 ?
 681. $16\frac{1}{2}$ is $\frac{7}{8}$ of how many times $\frac{1}{5}$ of 54 ?
 682. $45\frac{1}{2}$ is $\frac{9}{10}$ of how many times $\frac{1}{2}$ of 40 ?
 683. 8 is $\frac{4}{7}$ of how many times $\frac{2}{3}$ of 3 ?
 684. $\frac{1}{2}$ of $\frac{3}{4}$ is $\frac{3}{40}$ of how many times $\frac{1}{3}$ of 15 ?
 685. $\frac{4}{5}$ of 20 is how many thirds of 24 ?

SOLUTION. — $\frac{4}{5}$ of 20 = 16; 16 is $\frac{1}{4}$ of 24; $\frac{1}{4} = \frac{1}{3}$. Therefore $\frac{4}{5}$ of 20 is 2 thirds of 24.

686. $\frac{1}{8}$ of 56 is how many fourths of 28 ?
 687. $\frac{3}{8}$ of 64 is how many fifths of 60 ?
 688. $\frac{2}{3}$ of 48 is how many sevenths of 28 ?
 689. $\frac{4}{5}$ of 108 is how many fourths of 32 ?
 690. $\frac{3}{20}$ of 160 is how many thirds of 36 ?
 691. $\frac{1}{15}$ of 90 is how many twelfths of 84 ?
 692. $\frac{3}{7}$ of 35 is $\frac{5}{8}$ of how many times 7 ?

SOLUTION. — $\frac{3}{7}$ of 35 = 15; 15 is $\frac{1}{2}$ of 24; 24 is $\frac{2}{7} = 3\frac{1}{3}$ times 7. Therefore $\frac{3}{7}$ of 35 is $\frac{1}{2}$ of $3\frac{1}{3}$ times 7.

693. $\frac{7}{8}$ of 54 is $\frac{9}{10}$ of how many times 5 ?
 694. $\frac{5}{4}$ of 24 is $\frac{3}{10}$ of how many times 12 ?
 695. $\frac{3}{5}$ of 75 is $\frac{9}{14}$ of how many times 8 ?
 696. $\frac{4}{7}$ of 56 is $\frac{2}{3}$ of how many times 20 ?
 697. $\frac{3}{8}$ of 108 is $\frac{4}{7}$ of how many times 9 ?
 698. $\frac{2}{11}$ of 121 is $\frac{2}{3}$ of how many times 7 ?
 699. $\frac{7}{8}$ of 33 is $\frac{7}{8}$ of how many times 6 ?
 700. $1\frac{2}{7}$ of 34 is $\frac{2}{7}$ of how many times 14 ?
 701. $\frac{5}{2}$ of 30 is $1\frac{5}{8}$ of how many times 20 ?
 702. $\frac{3}{7}$ of $\frac{1}{3}$ of 63 is $\frac{1}{4}$ of $\frac{3}{5}$ of how many times 11 ?
 703. $\frac{4}{5}$ of $\frac{3}{4}$ of 50 is $\frac{3}{4}$ of $\frac{1}{3}$ of how many times 8 ?
 704. $\frac{4}{5}$ of 56 is $\frac{8}{9}$ of 3 times what number ?

SOLUTION. — $\frac{4}{5}$ of 56 = 32; 32 is $\frac{8}{9}$ of 36; 36 is 3 times 12. Therefore $\frac{4}{5}$ of 56 is $\frac{8}{9}$ of 3 times 12.

705. $\frac{4}{5}$ of 45 is $\frac{5}{7}$ of 6 times what number ?
 706. $\frac{5}{8}$ of 64 is $\frac{4}{5}$ of 9 times what number ?

707. $\frac{3}{7}$ of 63 is $\frac{9}{18}$ of 4 times what number?
 708. $\frac{2}{3}$ of 36 is $\frac{3}{10}$ of 5 times what number?
 709. $\frac{4}{11}$ of 110 is $\frac{5}{7}$ of 8 times what number?
 710. $\frac{1}{10}$ of 80 is $\frac{5}{8}$ of 11 times what number?
 711. $\frac{7}{8}$ of 72 is $\frac{9}{10}$ of 5 times what number?
 712. $\frac{3}{5}$ of 81 is $\frac{1}{2}$ of 10 times what number?
 713. $\frac{2}{3}$ of 21 is $\frac{7}{4}$ of 8 times what number?
 714. $\frac{1}{7}$ of 42 is $\frac{3}{7}$ of 7 times what number?
 715. $\frac{3}{4}$ of $\frac{2}{3}$ of 70 is $\frac{5}{12}$ of 4 times what number?
 716. $\frac{4}{7}$ of 35 is $\frac{5}{8}$ of how many thirds of 18?

SOLUTION. — $\frac{4}{7}$ of 35 = 20; 20 is $\frac{5}{8}$ of 32; 32 = $\frac{1}{3}$ of 96, or $\frac{1}{3}$ of 18.
 Therefore $\frac{4}{7}$ of 35 is $\frac{5}{8}$ of 6 thirds of 18.

717. $\frac{2}{3}$ of 42 is $\frac{4}{7}$ of how many fifths of 35?
 718. $\frac{3}{8}$ of 96 is $\frac{5}{8}$ of how many eighths of 24?
 719. $\frac{2}{3}$ of 180 is $\frac{3}{8}$ of how many tenths of 50?
 720. $\frac{5}{7}$ of 84 is $\frac{3}{4}$ of how many sixths of 48?
 721. $\frac{7}{20}$ of 100 is $\frac{7}{10}$ of how many ninths of 45?
 722. $\frac{3}{8}$ of 45 is $\frac{5}{12}$ of how many halves of 48?
 723. $\frac{6}{11}$ of 77 is $\frac{7}{9}$ of how many twelfths of 72?
 724. $\frac{1}{10}$ of 30 is $\frac{2}{7}$ of how many thirds of 21?
 725. $\frac{9}{14}$ of 28 is $\frac{3}{20}$ of how many fourths of 24?
 726. $\frac{5}{8}$ of 18 is $\frac{6}{11}$ of how many twelfths of 60?
 727. $\frac{3}{4}$ of 80 is $\frac{2}{3}$ of how many fourths of 40?
 728. $\frac{7}{8}$ of 42 is $\frac{9}{11}$ of how many twelfths of 72?
 729. $\frac{4}{18}$ of 39 is $\frac{3}{5}$ of how many ninths of 180?
 730. $\frac{5}{9}$ of $\frac{3}{8}$ of 18 is 4 times what part of 35?

SOLUTION. — $\frac{5}{9}$ of $\frac{3}{8}$ of $\frac{2}{3}$ of 18 = 20; 20 is 4 times 5; 5 is $\frac{5}{35} = \frac{1}{7}$ of 35.

35. Therefore $\frac{5}{9}$ of $\frac{6}{3}$ of 18 is 4 times $\frac{1}{7}$ of 35.

731. $\frac{4}{5}$ of $\frac{3}{8}$ of 40 is 3 times what part of 24?
 732. $\frac{2}{3}$ of $\frac{7}{8}$ of 49 is 2 times what part of 28?
 733. $\frac{1}{2}$ of $\frac{9}{10}$ of 100 is 9 times what part of 25?

734. $\frac{5}{8}$ of $\frac{7}{4}$ of 48 is 7 times what part of 35?

735. $\frac{7}{10}$ of $\frac{3}{4}$ of 60 is 7 times what part of 64?

736. $\frac{3}{4}$ of $\frac{2}{3}$ of 80 is 3 times what part of 96?

737. $\frac{4}{5}$ of 36 is $\frac{4}{5}$ of how many times $\frac{2}{3}$ of 42?

SOLUTION. — $\frac{4}{5}$ of 36 = 48; 48 is $\frac{4}{5}$ of 108; $\frac{2}{3}$ of 42 = 12; 108 = 9 times 12. Therefore $\frac{4}{5}$ of 36 is $\frac{4}{5}$ of 9 times $\frac{2}{3}$ of 42.

738. $\frac{3}{8}$ of 64 is $\frac{4}{5}$ of how many times $\frac{2}{3}$ of 15?

739. $\frac{4}{5}$ of 27 is $\frac{3}{4}$ of how many times $\frac{3}{8}$ of 56?

740. $\frac{7}{9}$ of 81 is $\frac{3}{2}$ of how many times $\frac{1}{4}$ of 28?

741. $\frac{6}{5}$ of 50 is $\frac{1}{12}$ of how many times $\frac{2}{3}$ of 60?

742. $\frac{3}{4}$ of 36 is $\frac{3}{11}$ of how many times $\frac{1}{3}$ of 27?

743. $\frac{5}{8}$ of 32 is $\frac{2}{5}$ of how many times $\frac{5}{9}$ of 45?

744. $\frac{3}{10}$ of 150 is $\frac{3}{4}$ of how many times $\frac{3}{8}$ of 40?

745. $\frac{4}{5}$ of 108 is $\frac{6}{10}$ of how many times $\frac{3}{8}$ of $16\frac{2}{3}$?

746. $\frac{1}{8}$ of 65 is $\frac{1}{7}$ of how many times $\frac{2}{3}$ of $\frac{3}{5}$ of 50?

747. $\frac{3}{5}$ of 60 is $\frac{1}{2}$ of how many times $\frac{5}{9}$ of 25?

748. $\frac{6}{5}$ of 72 is $\frac{2}{3}$ of how many times $\frac{1}{2}$ of $\frac{4}{7}$ of 70?

749. $\frac{4}{5}$ of $\frac{2}{3}$ of 90 is $\frac{1}{2}$ of $\frac{3}{4}$ of how many times $\frac{4}{5}$ of $\frac{2}{3}$ of 20?

750. $\frac{1}{5}$ of $\frac{5}{6}$ of 36 is $\frac{1}{5}$ of $\frac{2}{3}$ of how many times $\frac{2}{3}$ of $\frac{5}{6}$ of 120?

751. Learn the following equivalents:

$\$ \frac{1}{2} = 50¢$	$\$ \frac{4}{5} = 80¢$	$\$ \frac{3}{4} = 85¢$	$\$ \frac{5}{9} = 55\frac{5}{9}¢$
$\$ \frac{1}{3} = 33\frac{1}{3}¢$	$\$ \frac{1}{5} = 16\frac{2}{5}¢$	$\$ \frac{1}{8} = 12\frac{1}{2}¢$	$\$ \frac{7}{9} = 77\frac{7}{9}¢$
$\$ \frac{2}{3} = 66\frac{2}{3}¢$	$\$ \frac{5}{8} = 83\frac{1}{8}¢$	$\$ \frac{3}{8} = 37\frac{1}{2}¢$	$\$ \frac{8}{9} = 88\frac{8}{9}¢$
$\$ \frac{1}{4} = 25¢$	$\$ \frac{1}{7} = 14\frac{2}{7}¢$	$\$ \frac{5}{8} = 62\frac{1}{2}¢$	$\$ \frac{1}{11} = 9\frac{1}{11}¢$
$\$ \frac{3}{4} = 75¢$	$\$ \frac{2}{3} = 28\frac{2}{3}¢$	$\$ \frac{7}{8} = 87\frac{1}{2}¢$	$\$ \frac{1}{12} = 8\frac{1}{12}¢$
$\$ \frac{1}{5} = 20¢$	$\$ \frac{3}{4} = 42\frac{3}{4}¢$	$\$ \frac{1}{9} = 11\frac{1}{9}¢$	$\$ \frac{1}{16} = 6\frac{1}{16}¢$
$\$ \frac{2}{5} = 40¢$	$\$ \frac{4}{7} = 57\frac{1}{7}¢$	$\$ \frac{2}{3} = 22\frac{2}{3}¢$	$\$ \frac{1}{20} = 5¢$
$\$ \frac{3}{5} = 60¢$	$\$ \frac{5}{7} = 71\frac{4}{7}¢$	$\$ \frac{4}{5} = 44\frac{4}{5}¢$	$\$ \frac{1}{25} = 4¢$

752. Change $\$ \frac{3}{4}$ to cents.

753. Change $\$ \frac{1}{2}$ to cents.

754. Change $87\frac{1}{2}$ cents to a fraction of a dollar.

755. Change $57\frac{1}{2}$ cents to a fraction of a dollar.

756. Add $66\frac{2}{3}\phi + 25\phi + 33\frac{1}{3}\phi$.

SOLUTION. — $\$ \frac{2}{3} + \$ \frac{1}{4} + \$ \frac{1}{8} = \$ \frac{8}{12} + \$ \frac{3}{12} + \$ \frac{1.5}{12} = \$ \frac{12.5}{12} = \$ 1\frac{1}{4} = \$ 1.25$.

757. Add $40\phi + 44\frac{1}{2}\phi + 22\frac{3}{4}\phi$.

758. From $22\frac{3}{4}\phi$ take $6\frac{1}{2}\phi$.

759. Multiply $28\frac{1}{2}\phi$ by $22\frac{3}{4}\phi$.

760. Divide $42\frac{1}{2}\phi$ by $33\frac{1}{3}\phi$.

PROBLEMS.

96. 1. William had 30 cents, and John had 1 half as much money. How much had John?

2. If a pound of candles costs 15 cents, how much will 1 third of a pound cost? 2 thirds?

3. George is 12 years old, and Mary is $\frac{2}{3}$ as old as he. How old is Mary?

4. If a barrel of flour costs \$10, and a barrel of vinegar $\frac{1}{2}$ as much, what is the cost of the vinegar?

5. If 3 tons of hay cost \$36, what part of \$36 will 1 ton cost? 2 tons?

6. There were 33 birds sitting on a telegraph wire; $\frac{2}{3}$ of them were frightened by a train and flew away. How many were left on the wire?

7. Edwin gave one half a peach to his sister, and one half to his brother. How many peaches did he give to both?

8. A farmer, having 44 sheep, sold $\frac{1}{4}$ of them. How many had he left?

9. If a ton of hay costs \$12, how much will $\frac{1}{4}$ of a ton cost? $\frac{2}{3}$? $\frac{3}{4}$?

10. If 5 bushels of apples cost 90 cents, what part of 90 cents will 1 bushel cost? 2 bushels? 3 bushels? 4 bushels?

11. When coal is \$5 a ton, what part of a ton can be bought for \$1? for \$2? \$3?

12. If 10 pounds of sugar cost 80 cents, what part of 80 cents will 3 pounds cost? 7 pounds?

13. If a man earns \$72 in 1 month, how much will he earn in $\frac{1}{4}$ of a month? $\frac{5}{8}$? $\frac{4}{5}$? $\frac{7}{8}$? $\frac{5}{12}$?

14. A piece of land is worth \$45. How much is $\frac{1}{4}$ of it worth? $\frac{2}{3}$? $\frac{3}{4}$?

15. If you pay \$30 for 1 bale of cotton, how much should you pay for $\frac{1}{2}$ of a bale? For $\frac{1}{3}$? For $\frac{5}{8}$? For $\frac{4}{5}$?

16. A man divided 48 cents equally among 6 boys. What part of the whole did each boy receive? What part did 2 boys receive? 3? 4? 5?

17. If in a basket of 54 eggs $\frac{1}{3}$ are bad, how many are good?

18. If a man earns \$15 a week, and spends $\frac{2}{3}$ of it, how much does he save?

19. A drover, having 60 sheep, sold $\frac{1}{4}$ of them at one time, and $\frac{1}{5}$ at another. How many had he left?

20. There were 18 towels in a drawer, and I used $\frac{2}{3}$ of them. How many did I use, and how many were left in the drawer?

21. If Harry bought 6 pounds of nuts for 1 dollar, what part of 1 dollar did 1 pound cost? 2 pounds? 3 pounds? 4 pounds?

22. When tea is 5 dimes a pound, what part of a pound can be bought for 1 dime? 2 dimes? 3 dimes? 4 dimes?

23. If 15 boxes exactly fill a case, how many boxes will fill $\frac{2}{3}$ of it? $\frac{3}{4}$ of it?

24. A man is 60 years old, and his wife is $\frac{4}{5}$ as old. How old is she ?

25. Andrew is 18 years old, and his sister Jane is $\frac{5}{6}$ as old. How old is Jane ?

26. If 36 yards of carpet exactly cover a floor, how much will 1 sixth of the floor require ? 3 sixths ?

27. If you divide a barrel of flour equally among 5 families, what part of the barrel will 1 family receive ? 2 families ? 3 families ? 4 families ? 5 families ?

28. If a man earns 72 dollars in 1 month, how much will he earn in 1 fourth of a month ? 5 sixths ? 4 ninths ? 7 eighths ? 5 twelfths ?

29. How much will $\frac{5}{8}$ of a bushel of chestnuts cost at 10 cents a quart ?

30. What will be the cost of $\frac{4}{5}$ of 14 dozen eggs at 11 cents a dozen ?

31. If James has 108 cents, and Henry has $\frac{7}{12}$ as many and 20 cents more, how many cents has Henry ?

32. What will be the cost of $\frac{3}{4}$ of a gallon of molasses at 12 cents a quart ?

33. Charles, having \$48, paid $\frac{1}{8}$ of his money for a hat, $\frac{3}{8}$ for a coat, and $\frac{1}{2}$ for some books and a quarter's tuition. How many dollars had he left ?

34. A man bought a horse for \$120; he paid for a carriage $\frac{7}{10}$ as much as for the horse, and for a harness $\frac{3}{4}$ as much as he paid for the carriage. How much did the whole cost him ?

35. If a man puts \$200 at interest, and receives $\frac{1}{4}$ of it annually for its use, how much does he receive in one year ?

36. If a vessel sails 12 miles an hour, how many times 9 miles will she sail in $\frac{3}{4}$ of a day ?

37. Frank has 49 marbles, and Fred has 10 less than *as many*. How many has Fred ?

38. A man, having 300 cedar posts, sold $\frac{2}{3}$ of them to A, $\frac{1}{3}$ to B, $\frac{2}{10}$ to C, and 40 posts to D. How many had he left?

39. What will be the cost of a gold watch weighing $\frac{1}{2}$ of a pound at \$1 a pennyweight?

40. What will be the cost of $\frac{3}{8}$ of 2 gallons of ice cream at 40 cents a pint?

41. A grocer bought 27 dozen eggs for \$2.40 cents, and sold $\frac{2}{3}$ of them for 12 cents a dozen, and the remainder for 10 cents a dozen. How much did he gain by the transaction?

42. If $\frac{1}{4}$ of a yard of cloth costs 12 cents, how much will 1 yard cost?

SOLUTION. — Since 1 yard is 4 times $\frac{1}{4}$ of a yard, it will cost 4×12 cents, or 48 cents.

43. If $\frac{1}{2}$ of a pound of tea costs 10 cents, how much will 1 pound cost?

44. If $\frac{1}{3}$ of a gallon of molasses costs 20 cents, how much will 1 gallon cost?

45. If $\frac{1}{2}$ of a cord of wood costs \$2, how much will 1 cord cost? How much will 2 cords cost?

46. A man paid 2 dimes for his lunch, which was $\frac{1}{12}$ of the money he had with him. How much had he?

47. There are 15 books on one shelf of a bookcase, which is $\frac{1}{4}$ of the whole number of books in the case. How many books are there in the case?

48. If $\frac{1}{4}$ of a ton of hay costs \$3, how much will $\frac{3}{8}$ cost? $\frac{5}{8}$? 1 ton?

49. If a steamer sails 45 miles in $\frac{1}{3}$ of a day, how far will she sail in 3 days?

50. James had 40 plums, and divided $\frac{1}{4}$ of them equally among 5 of his companions. How many did he give to each?

51. A man lost \$16, which was $\frac{1}{3}$ of what he had received for selling 12 sheep. What price per head did he charge for the sheep?

52. A man plowed 36 acres of his farm; $\frac{3}{4}$ of this was equal to $\frac{1}{3}$ of the whole number of acres in his farm. How many acres were there in his farm?

53. A pole stands 12 feet in the water; the part in the water is $\frac{1}{3}$ the whole length of the pole. How long is the pole?

54. A florist sold a palm for \$15, which was $\frac{1}{4}$ of what he received for some rubber plants. For how much did he sell the rubber plants?

55. If $\frac{1}{1\frac{1}{2}}$ of an acre of land costs \$5, how much will 2 acres cost?

56. If $\frac{3}{4}$ of a barrel of flour costs \$6, how much will 1 barrel cost?

SOLUTION. — 1 fourth of a barrel will cost $\frac{1}{4}$ of \$6, or \$2, and 4 fourths will cost $4 \times \$2$, or \$8.

57. If $\frac{4}{5}$ of a barrel of oil costs \$8, how much will 1 barrel cost?

58. If $\frac{5}{6}$ of a month's wages amounts to \$25, how much will a month's wages amount to? 2 months'?

59. How much will 1 barrel of pork cost, if $\frac{5}{7}$ of a barrel costs \$10?

60. I read 25 pages of a book to-day, which is $\frac{5}{4}$ of the number I read yesterday. How many pages did I read yesterday?

61. A grocer bought 4 barrels of vinegar at \$6 a barrel, which was but $\frac{2}{3}$ of its real value. What was its real value per barrel?

62. A butcher bought some pork for \$90, which was 9 elevenths of what he sold it for. How much did he *gain*?

63. A tailor bought two pieces of cloth, the shorter piece containing 24 yards; $\frac{2}{3}$ the number of yards in the shorter piece is 20 yards less than the number of yards in the longer piece. How many yards are there in both pieces?

64. If $\frac{7}{10}$ of an acre of land yields 28 bushels of wheat, how much will 1 acre yield? 3 acres?

65. Of a certain farm, 36 acres are woodland, and $\frac{2}{3}$ of the woodland is $\frac{2}{3}$ of the number of acres of cleared land. How many acres of cleared land are there, and how many acres does the farm contain?

66. Mr. Smith gave $\frac{1}{2}$ of all the money he had for a horse; he then paid \$12 for a saddle and bridle, which was $\frac{2}{3}$ of all the money he had left. How much money had he at first?

67. A person, being asked his age, answered that if he were twice as old, $\frac{1}{3}$ of his age would be 20 years. How old was he?

68. James has \$ $\frac{2}{3}$, John \$ $\frac{2}{3}$, and George \$ $\frac{1}{3}$. How many fifths of a dollar have they all? How many dollars?

SOLUTION. — They all have $\frac{2}{3} + \frac{2}{3} + \frac{1}{3}$, equal to $\frac{5}{3}$ dollars, or $1\frac{2}{3}$ dollars.

69. Jane had \$ $\frac{1}{2}$, and her father gave her \$ $\frac{1}{2}$ more. How much had she then?

70. Edwin bought a pair of skates for $\frac{1}{2}$ of a dollar, a pair of mittens for $\frac{1}{3}$ of a dollar, and a slate for $\frac{1}{6}$ of a dollar. What was the cost of all?

71. A grocer sold $\frac{1}{2}$ of a dozen eggs to one man, $\frac{1}{3}$ of a dozen to another, and $\frac{1}{6}$ of a dozen to another. How many dozen did he sell to all?

SOLUTION. — He sold $\frac{1}{2} + \frac{1}{3} + \frac{1}{6} = \frac{3}{6} + \frac{2}{6} + \frac{1}{6} = \frac{6}{6}$ dozen = 1 dozen.

72. Mary paid $\frac{3}{8}$ of a dollar for some ribbon, $\frac{5}{8}$ of a dollar for a pair of gloves, and $\frac{1}{8}$ of a dollar for some lace. How much did they all cost?

73. A real estate agent sold $\frac{3}{8}$ of an acre of land to one man, $\frac{3}{8}$ to another, and $\frac{7}{16}$ to another. How much did he sell in all?

74. A laborer dug $\frac{1}{4}$ a rod of ditch the first hour, $\frac{3}{8}$ of a rod the second, $\frac{3}{8}$ the third, and $\frac{7}{16}$ the fourth. How many rods did he dig in 4 hours?

75. A farmer sold $\frac{1}{8}$ of his grain to one man, $\frac{3}{8}$ to another, and $\frac{1}{8}$ to another. What part of his grain did he sell?

76. A carpenter paid \$2 $\frac{1}{8}$ for a saw, \$1 $\frac{3}{4}$ for a hammer, and \$ $\frac{1}{8}$ for nails. How much did he spend altogether?

SOLUTION. — $\$2 + \$1 = \$3$; $\$ \frac{1}{8} + \$ \frac{3}{4} + \$ \frac{1}{8} = \$ \frac{1}{2} + \$ \frac{3}{4} + \$ \frac{1}{4} = \$ \frac{1}{2} + \$ 1 = \$ 1 \frac{1}{2}$; $\$3 + \$1 \frac{1}{2} = \$4 \frac{1}{2}$. He spent \$4 $\frac{1}{2}$ altogether.

77. Henry saved \$ $\frac{5}{8}$ one week, \$ $\frac{3}{8}$ the next, \$1 $\frac{1}{8}$ the next, and \$2 $\frac{1}{4}$ the next. How much did he save in 4 weeks?

78. Albert picked 2 $\frac{1}{4}$ bushels of apples from one tree, 3 $\frac{3}{4}$ from another, and 3 $\frac{1}{2}$ from another. How many bushels did he pick from the 3 trees?

79. If it takes 4 $\frac{1}{9}$ yards of cloth for a coat, 2 $\frac{1}{3}$ yards for a pair of pants, and $\frac{7}{9}$ of a yard for a vest, how many yards of cloth will it take for the whole suit?

80. If a man walks 12 $\frac{5}{8}$ miles in the forenoon and 10 $\frac{1}{8}$ miles in the afternoon, how many miles does he walk during the day?

81. A boy bought a book for \$ $\frac{5}{8}$ and sold it for \$ $\frac{1}{8}$ more than it cost him. For how much did he sell it?

82. Three men bought a horse. A paid \$25 $\frac{7}{12}$, B paid \$30 $\frac{7}{12}$, and C paid \$35 $\frac{5}{12}$. What was the cost of the horse?

83. If coal is worth $\$5\frac{7}{8}$ a ton, and wood is worth $\$3\frac{5}{12}$ a cord, what will be the cost of 1 ton of coal and 2 cords of wood?

84. Fred having $\$ \frac{5}{6}$, gave away $\$ \frac{2}{3}$. How much had he left?

SOLUTION. — He had left the difference between $\$ \frac{5}{6}$ and $\$ \frac{2}{3}$; $\$ \frac{5}{6} - \$ \frac{2}{3} = \$ \frac{1}{6}$, or $\$ \frac{1}{2}$. He had $\$ \frac{1}{2}$ left.

85. A farmer gathered $\frac{7}{8}$ of a bushel of peaches; he sold $\frac{3}{8}$ of a bushel. What part of a bushel had he left?

86. A student paid $\frac{5}{8}$ of a dollar for a geography, and $\frac{1}{4}$ of a dollar for a philosophy. For which did he pay the more, and how much?

87. Two men together own a piece of property; one owns $\frac{2}{3}$ of it. How much does the other own?

88. When rye is worth $\frac{7}{8}$ of a dollar per bushel and corn is worth $\frac{5}{8}$ of a dollar, what is the difference in price between them?

89. A grocer sells $\frac{1}{3}$ of a box of tea from a box $\frac{2}{3}$ full. What part of the whole box is left?

90. Henry can run $\frac{7}{8}$ of a mile in the same time that John can run $\frac{1}{2}\frac{7}{8}$ of a mile. Which runs the faster, and how much?

91. There are $\frac{7}{8}$ bushels of corn in one bin, and $\frac{3}{4}$ bushels in another. What is the difference in the contents of the bins?

92. A man bought a ton of coal and used $1\frac{5}{8}$ of it. What part of a ton had he left?

93. If Robert earns $\$7\frac{3}{4}$ a week, and Henry earns $\$6\frac{1}{2}$ a week, how much more than Henry does Robert earn?

94. Arthur gathered $10\frac{7}{8}$ quarts of raspberries, and sold $7\frac{1}{2}$ quarts. How many quarts had he left?

95. From a piece of cloth containing $12\frac{1}{2}$ yards $5\frac{3}{4}$ yards were cut. How many yards remained?

96. If I put \$15 $\frac{1}{2}$ in the bank at one time, how much must I afterwards put in to make the sum \$20?

97. From a cask containing 63 gallons of molasses, 9 $\frac{3}{4}$ gallons were drawn. How many gallons remained?

98. Edgar will be 14 years old 3 $\frac{5}{12}$ years hence. How old is he now?

99. From a jug of molasses containing 1 gallon, $\frac{7}{8}$ of a quart was used. How much was left?

100. If I buy a book for $\frac{3}{4}$ of a dollar and give in payment a 2-dollar bill, how much change should I receive?

101. A man earned \$18 $\frac{3}{4}$, and spent \$5 $\frac{1}{4}$ the first week. How much money had he left?

102. Mr. Smith sold $\frac{1}{3}$ of his estate to A, $\frac{1}{4}$ of it to B, and $\frac{1}{4}$ of it to C. What part remained unsold?

103. A newsboy sold $\frac{1}{3}$ of his papers, and gave $\frac{1}{2}$ of them to a companion to sell. What part had he left?

104. $\frac{1}{3}$ of my money is in silver, $\frac{1}{4}$ in bills, $\frac{1}{8}$ in gold, and the rest in checks. What part of all my money is in the form of checks?

105. A laborer worked 3 times for \$1 $\frac{1}{2}$, \$ $\frac{3}{4}$, and \$1 $\frac{1}{2}$. Had he received \$2 each time, how much more would he have had?

106. From a piece of cloth containing 32 $\frac{1}{2}$ yards, two dress patterns were cut, one containing 10 $\frac{1}{2}$ yards and the other 12 $\frac{3}{4}$ yards. How many yards remained in the piece?

107. I deposited in the bank at one time \$20 $\frac{1}{2}$, at another \$15 $\frac{1}{2}$. How much more must I deposit to make the amount \$50?

108. I paid \$6 $\frac{1}{2}$ for a barrel of flour, \$5 $\frac{1}{2}$ for a ton of coal, and gave in payment a 10-dollar bill and a 5-dollar bill. How much change should I receive?

109. A merchant bought 5 barrels of flour, at \$15 a barrel, and paid part of the value in goods worth \$45 $\frac{3}{10}$, and the remainder in cash. How much cash did he pay?

110. If you divide \$ 80 among three men, giving the first $\frac{1}{4}$ of it, and the second \$ 35 $\frac{1}{4}$, how much will the third receive ?

111. A farmer, having 120 bushels of oats to sell, sold 15 $\frac{1}{4}$ bushels more than $\frac{1}{4}$ of them at one time, and 20 bushels less than $\frac{1}{4}$ of them at another time. How many bushels had he left ?

112. Charles paid $\frac{1}{4}$ of his money for a book, $\frac{3}{8}$ for some paper, and had 39 cents left. How much had he at first ?

113. John is 10 $\frac{1}{8}$ years old, James is 9 $\frac{3}{4}$ years old, and the sum of their ages is 5 $\frac{3}{8}$ years more than Frank's age. How old is Frank ?

114. Frank is 9 $\frac{1}{4}$ years old, and Henry is 5 $\frac{1}{4}$ years less than twice as old as Frank. What is the difference in their ages ?

115. A man, having \$ 64, bought 3 cows. For the first cow he gave $\frac{1}{8}$ of it, for the second $\frac{2}{3}$ of it, and the remainder for the third. What was the cost of the third cow ?

116. From a cask containing 63 gallons a grocer drew 20 $\frac{3}{4}$ gallons of molasses at one time, and 3 $\frac{1}{8}$ gallons at another time. How many gallons remained ?

117. How much will 5 pounds of tea cost, at $\frac{3}{4}$ of a dollar a pound ?

SOLUTION. — 5 pounds will cost $5 \times \frac{3}{4}$, or $1\frac{3}{4}$, of a dollar, equal to \$ 3 $\frac{3}{4}$.

118. How much will 4 yards of linen cost, at $\frac{5}{8}$ of a dollar a yard ?

119. When sugar is $\frac{1}{4}$ of a dollar a pound, how much will 25 pounds cost ?

120. If $\frac{4}{5}$ of a pound of butter lasts a family 1 day, how many pounds will last them 1 week ?

121. What will be the cost of 10 peaches, at $\frac{7}{8}$ of a cent apiece?

122. If a man earns $\frac{9}{10}$ of a dollar a day, how much will he earn in 12 days?

123. If 1 peck of peas costs $\frac{1}{8}$ of a dollar, how much will 2 bushels cost?

124. If you buy 8 dolls at $\$ \frac{5}{8}$ each, how much money will you spend for them?

125. At $\frac{3}{8}$ of a dime a pound, how much will 15 pounds of nails cost?

126. How much will 9 yards of silk cost, at $1\frac{1}{2}$ of a dollar a yard?

127. George had $\frac{1}{2}\frac{3}{8}$ of a dollar, and William had 8 times as much. How much had William?

128. If a horse eats $\frac{3}{7}$ of a ton of hay in a month, how much will 10 horses eat in the same time?

129. If 1 man can reap $\frac{4}{5}$ of an acre of rye in a day, how much can 11 men reap?

130. How many barrels of flour will be given to 9 families, if each receives $\frac{7}{8}$ of a barrel?

131. At 8 different times I cut $\frac{5}{8}$ of a yard from a piece of ribbon, and I then had 5 yards left. How many yards were there in the piece?

132. If 1 quart of molasses costs $\$ \frac{3}{16}$, how much will 4 gallons cost at the same rate?

133. If a boy gives each of his 4 companions $\frac{3}{8}$ of a quart of chestnuts, and has $4\frac{1}{8}$ quarts left, how many quarts had he at first?

134. If 1 box of raisins costs $\$ 2\frac{3}{4}$, how much will 5 boxes cost?

SOLUTION. — $5 \times \$ \frac{3}{4} = \$ \frac{15}{4}$, or $\$ 3\frac{3}{4}$; $5 \times \$ 2 = \$ 10$; $\$ 3\frac{3}{4} + \$ 10 = \$ 13\frac{3}{4}$. Five boxes will cost $\$ 13\frac{3}{4}$.

135. At $22\frac{1}{2}$ cents a pound, how much will 9 pounds of butter cost?

136. At \$ $6\frac{3}{4}$ a barrel, how much will 7 barrels of flour cost ?

137. How many bushels of grain will 15 bags hold, if they hold $2\frac{1}{2}$ bushels apiece ?

138. What will be the cost of 12 pounds of rice, at $6\frac{1}{4}$ cents a pound ?

139. How much will 9 dozen eggs cost, at $11\frac{1}{2}$ cents a dozen ?

140. How much will 7 yards of cloth cost, at \$ $5\frac{7}{8}$ a yard ?

141. If 1 barrel of fish costs \$ $14\frac{3}{8}$, how much will 6 barrels cost ?

142. If 1 horse eats $3\frac{1}{4}$ tons of hay in 5 months, how many tons will 20 horses eat in the same time ?

143. If 1 pint of cologne costs \$ $1\frac{1}{5}$, how much will 1 gallon cost ?

144. If 5 men can do a piece of work in $10\frac{3}{4}$ days, how long will it take 1 man to do the same work ?

145. If a grain of gold is worth $4\frac{1}{2}$ cents, what is 1 pennyweight worth ?

146. A grocer sold 9 pounds of coffee at $12\frac{1}{2}$ cents a pound, and 7 pounds of sugar at $8\frac{3}{4}$ cents a pound. How much did he receive for both ?

147. If it takes $3\frac{3}{8}$ yards of cloth for a coat, and $2\frac{1}{4}$ yards for a pair of trousers, how many yards will be required to make 3 of each ?

148. If 1 pound of cheese costs 10 cents, how much will $5\frac{3}{8}$ pounds cost ?

SOLUTION. — $5 \times 10\phi = 50\phi$; $\frac{3}{8}$ of 10 cents = $3\frac{3}{4}$ cents; 50ϕ cents + $3\frac{3}{4}$ cents = $53\frac{3}{4}$ cents.

Or, $5\frac{3}{8}$ pounds = $\frac{43}{8}$ lb.; $\frac{43}{8} \times 10\phi = \frac{430}{8}\phi = 53\frac{3}{4}$ cents.

149. If a horse travels 6 miles an hour, how far will it travel in $7\frac{3}{4}$ hours ?

150. If a man's expenses are \$ 12 a week, how much will they be for $9\frac{1}{4}$ weeks?

151. How much will $4\frac{3}{8}$ barrels of vinegar cost at \$ 3 a barrel?

152. How much will $10\frac{1}{4}$ pounds of honey cost at 12 cents a pound?

153. How much will $15\frac{3}{8}$ bushels of potatoes cost at 8 dimes a bushel?

154. If a quart of cream is worth 40 cents, how much are $3\frac{1}{2}$ pints worth?

155. If a man can build 4 rods of wall in a day, how many rods can he build in $7\frac{5}{8}$ days?

156. If a barrel of flour lasts a family 6 weeks, how long will $4\frac{1}{2}$ barrels last them?

157. If stage fare is 4 cents a mile, how much will it cost to ride $20\frac{3}{4}$ miles?

158. If a merchant pays \$ 12 for 3 bonnets, and sells them for \$ $6\frac{1}{2}$ apiece, what is his gain?

159. I planted $9\frac{1}{2}$ rows of pansies with 12 plants each, and $12\frac{5}{8}$ rows with 7 plants each. How many pansy plants were planted altogether?

160. If I buy $8\frac{3}{8}$ tons of coal, at \$ 5 a ton, how much less than \$ 50 will it cost?

161. A woman took $6\frac{3}{8}$ dozen eggs to market, and sold them for 12 cents a dozen; she received in payment $4\frac{1}{2}$ yards of cloth at 10 cents a yard, and $3\frac{1}{4}$ yards of ribbon at 8 cents a yard. How much was still due her?

162. If $\frac{7}{8}$ of a barrel of flour lasts a family 1 month, how many barrels will last 8 such families $6\frac{3}{8}$ months?

163. A man, owning $\frac{1}{2}$ of a store, sold $\frac{1}{4}$ of his share. What part of the whole store did he sell?

SOLUTION. — He sold $\frac{1}{4}$ of $\frac{1}{2}$, or $\frac{1}{4}$ of the store.

164. James had $\frac{1}{4}$ of a dollar, and gave $\frac{1}{4}$ of it to a beggar. What part of a dollar did he give away?

165. A boy, having $\frac{1}{2}$ of a watermelon, gave away $\frac{1}{4}$ of what he had. What part of the whole melon did he give away?

166. If a yard of silk costs $\$ \frac{1}{2}$, how much will $\frac{1}{3}$ of a yard cost?

167. If I own $\frac{1}{3}$ of an acre of land, and sell $\frac{1}{6}$ of it, what part of an acre do I sell?

168. If a bushel of apples is worth $\frac{1}{2}$ of a dollar, how much is $\frac{1}{3}$ of a bushel worth?

169. John is $\frac{1}{3}$ as old as his father, and Henry is $\frac{1}{4}$ as old as his brother John. What part of his father's age is Henry's age?

170. A merchant, having $\frac{1}{2}$ of a hogshead of molasses, sold $\frac{1}{4}$ of what he had. What part of the whole hogshead did he sell, and what part had he left?

171. Henry bought $\frac{1}{2}$ a box of figs, and Robert bought $\frac{1}{4}$ as many. What part of a box did both together buy?

172. $\frac{1}{2}$ of a grocer's case was filled with bottles of jam, and $\frac{1}{3}$ of that part was filled with pint bottles. What part of the whole case did the pint bottles fill?

173. Mr. Jones, owning $\frac{1}{2}$ of a cotton mill, sold $\frac{1}{3}$ of his share to B, and B sold $\frac{1}{4}$ of his share to C. What part of the whole did each have after the division?

174. A cistern, being full of water, sprang a leak, and before it could be stopped $\frac{1}{2}$ of the water ran out, but $\frac{1}{4}$ as much ran in at the same time. What part of the cistern was emptied?

175. A man, having $\frac{1}{2}$ of a barrel of flour, gave $\frac{1}{4}$ of it to a neighbor, who gave $\frac{1}{4}$ of his share to his neighbor. What part of a barrel had each then?

176. At $\$ 8\frac{1}{2}$ a barrel, how much will $\frac{3}{4}$ of a barrel of flour cost?

$$\text{SOLUTION. — } \$ 8\frac{1}{2} = \frac{\$ 17}{2}; \frac{3}{4} \text{ of } \frac{\$ 17}{2} = \frac{\$ 33}{4} = \$ 8\frac{1}{4}.$$

177. At \$ $6\frac{1}{4}$ a bushel, how much will $\frac{3}{8}$ of a bushel of clover seed cost?

178. At \$ $12\frac{3}{8}$ a ton, how much will $\frac{5}{8}$ of a ton of hay cost?

179. If a man travels $24\frac{1}{2}$ miles in 1 day, how far will he travel in $\frac{1}{3}$ of a day?

180. How much will $\frac{3}{8}$ of a barrel of beef cost, at \$ $15\frac{3}{4}$ a barrel?

181. What will be the cost of $\frac{1}{4}$ of a cord of wood, if 1 cord costs \$ $5\frac{1}{8}$?

182. At \$ $1\frac{1}{2}$ a day, how much can a man earn in $\frac{3}{4}$ of a day?

183. If a man can cut $3\frac{1}{2}$ acres of rye in 1 day, how much can he cut in $\frac{5}{8}$ of a day?

184. If I pay \$ $6\frac{3}{8}$ for a jar of butter, how much is $\frac{1}{4}$ of it worth?

185. A man bought a horse for \$ $75\frac{1}{2}$, and sold it for $\frac{4}{5}$ of what it cost. What was the loss?

186. At \$ $\frac{2}{3}$ a yard, how much will $6\frac{1}{4}$ yards of flannel cost?

SOLUTION. — $6 \times \$\frac{2}{3} = \4 , or \$4; $\frac{1}{4}$ of \$ $\frac{2}{3}$ is \$ $\frac{1}{6}$, or \$ $\frac{1}{6}$; \$4 + \$ $\frac{1}{6}$ = \$ $4\frac{1}{6}$.

Or, $6\frac{1}{4} = \frac{25}{4}$; $\frac{25}{4}$ of \$ $\frac{2}{3}$ = \$ $4\frac{1}{6}$.

187. At \$ $\frac{3}{4}$ a bushel, how much will $8\frac{1}{3}$ bushels of peaches cost?

188. Andrew, having \$ $\frac{3}{4}$, gave $\frac{2}{5}$ of it for a knife. What part of a dollar did he pay for his knife?

SOLUTION. — He paid $\frac{2}{5}$ of \$ $\frac{3}{4}$ = \$ $\frac{3}{10}$.

189. If a yard of cloth is worth \$ $\frac{7}{8}$, how much is $\frac{1}{4}$ of a yard worth?

190. Harriet, having $\frac{4}{5}$ of a yard of silk, gave $\frac{3}{4}$ of it to her sister. What part of a yard had she left?

191. A man, owning $\frac{2}{3}$ of a farm, sold $\frac{1}{3}$ of his share to his brother. What part of the farm did each own?

192. A little girl picked $\frac{9}{10}$ of a pailful of strawberries, and on her way home spilled $\frac{2}{5}$ of them. What part of a pailful had she left?

193. What will be the cost of $\frac{3}{4}$ of a bushel of beans, at $\$ \frac{8}{9}$ a bushel?

194. James, having $\frac{4}{5}$ of a pound of candy, gave $\frac{1}{5}$ of it to Mary, and $\frac{1}{5}$ of it to Jane. What part of a pound had he left?

195. A horse was given a bagful of oats to eat. He let $\frac{1}{4}$ of it fall out on the sides, ate $\frac{2}{3}$ of the remainder, and left the rest in the bag. What part of the whole was left in the bag?

196. If a man can hoe $\frac{7}{8}$ of an acre of corn in 1 day, how many acres can he hoe in $5\frac{3}{4}$ days?

197. If a vessel sails $12\frac{4}{5}$ miles in 1 hour, how far does she sail in $\frac{3}{4}$ of an hour?

198. If a man has $22\frac{3}{4}$ bushels of clover seed, and he sells $\frac{3}{4}$ of it, how much has he left?

199. How much will $\frac{1}{3}$ of $\frac{1}{2}$ of 12 gallons of oil cost, at $\$ \frac{7}{10}$ a gallon?

200. At $\$ \frac{3}{4}$ a rod, how much will it cost to dig $\frac{1}{2}$ of $\frac{3}{4}$ of 28 rods of ditch?

201. How much will $4\frac{1}{2}$ yards of cloth cost, at $\$ 2\frac{1}{4}$ a yard?

202. If you earn $\$ 8\frac{1}{2}$ in 1 week, how much can you earn in $2\frac{3}{4}$ weeks?

203. How much will $2\frac{5}{8}$ dozen eggs cost, at $10\frac{1}{2}$ cents a dozen?

204. How much will $3\frac{3}{4}$ yards of cloth cost, at $\$ 1\frac{3}{10}$ a yard?

205. If a man can do a certain piece of work in $5\frac{1}{4}$ days, in what time can he do a piece of work $1\frac{3}{4}$ times as large?

206. Jane is $7\frac{1}{4}$ years old, and Kate is $\frac{2}{3}$ as old. How old is Kate?

207. A man paid \$16 $\frac{2}{3}$ for a cow, and $2\frac{1}{2}$ times as much for a colt. How much did he pay for the two?

208. If 3 pounds of raisins cost \$ $\frac{2}{7}$, how much will 1 pound cost?

SOLUTION. — If 3 pounds cost \$ $\frac{2}{7}$, 1 pound will cost $\frac{1}{3}$ of \$ $\frac{2}{7}$, or \$ $\frac{2}{21}$.

209. If 4 slates cost \$ $\frac{3}{5}$, how much will 1 slate cost?

210. If 5 pounds of sugar cost \$ $\frac{5}{9}$, how much will 1 pound cost?

211. If 3 oranges are worth $\frac{2}{7}$ of a melon, what part of the melon is 1 orange worth?

NOTE. — It should be remembered that a *fraction* may be *divided* by a *whole* number, either by *dividing* the *numerator* or by *multiplying* the *denominator* by it.

212. If 2 pounds of coffee cost \$ $\frac{2}{3}$, how much will 1 pound cost?

213. If 4 apples cost $\frac{5}{8}$ of a dime, how much will 1 apple cost?

214. If 5 yards of sheeting cost \$ $\frac{2}{3}$, how much will 1 yard cost?

215. If 4 figs cost $\frac{2}{5}$ of a dime, how much will 1 fig cost?

216. How much will 1 yard of linen cost, if 4 yards cost \$ $\frac{7}{4}$?

217. John has $\frac{3}{4}$ of a melon, which he wishes to divide equally between his 2 sisters. What part must he give to each?

218. A man had 12 quarts of blueberries, and sold $\frac{1}{3}$ of them for \$ $\frac{1}{4}$. How much was that a quart?

219. If 6 persons agree to share equally $\frac{3}{4}$ of a bushel of grapes, what part of a bushel will each have?

220. If you divide $\frac{7}{8}$ of a barrel of flour equally among 3 families, what part of a barrel must you give to each?

221. At $\$ \frac{3}{4}$ a yard, how many yards of silk can be bought for $\$ 6$?

SOLUTION. — As many yards as $\$ \frac{3}{4}$ is contained times in $\$ 6$; $\$ 6$ is equal to $\$ \frac{24}{4}$, and $\$ \frac{3}{4}$ is contained in $\$ \frac{24}{4}$, 8 times. Therefore 8 yards of silk can be bought for $\$ 6$.

222. If a boy can earn $\$ \frac{3}{5}$ a day, how long will it take him to earn $\$ 5$?

223. How long will it take a man to spend $\$ 10$ for lunch, if he spends $\$ \frac{1}{4}$ a day?

224. When potatoes are $\$ \frac{3}{5}$ a bushel, how many bushels can be bought for $\$ 8$?

225. At $\$ \frac{7}{5}$ a pair, how many pairs of shoes can be bought for $\$ 7$?

226. How much butter can be bought for $\$ 3$, at $\$ \frac{1}{5}$ a pound?

227. If a car runs $\frac{2}{3}$ of a mile a minute, how long will it be in running 25 miles?

228. If a horse eats $\frac{3}{4}$ of a bushel of oats a day, how long will 9 bushels last him?

229. If a man walks $\frac{4}{5}$ of a mile in $\frac{1}{3}$ of an hour, how long will it take him to walk 12 miles?

230. How many bushels of oats, worth $\$ \frac{2}{3}$ a bushel, will pay for $\frac{2}{3}$ of a barrel of flour, worth $\$ 9$ a barrel?

231. A farmer sold a grocer 1 ton of hay for $\$ 12$, and for payment received $\frac{1}{2}$ the amount in sugar at $\$ \frac{1}{4}$ a pound, $\frac{1}{3}$ in money, and the remainder in molasses at $\$ \frac{2}{3}$ a gallon. How many pounds of sugar and how many gallons of molasses did he receive?

232. If $\frac{1}{3}$ of a barrel of fish costs $\$ 12$, how much will 1 barrel cost?

233. If $\frac{5}{8}$ of a ton of hay costs $\$ 7$, how much will 1 ton cost?

234. How many yards of ribbon, at $\$ \frac{5}{4}$ a yard, can be bought for $\$ 7$?

235. When potatoes are worth $\$ \frac{4}{5}$ a bushel, and corn $\$ \frac{5}{8}$ a bushel, how many bushels of potatoes are equal in value to 16 bushels of corn?

236. If a family consumes $\frac{3}{4}$ of a dozen rolls in a day, how long would six dozen rolls last?

237. If $\frac{2}{3}$ of a hogshead of molasses costs \$36, how much will 1 hogshead cost?

238. If $\frac{3}{4}$ of an acre of land is sold for \$21, how much will an acre cost at the same rate?

239. How many pounds of tea, worth $\$ \frac{7}{12}$ a pound, must be given for 9 bushels of apples, worth $\$ \frac{4}{5}$ a bushel?

240. At \$2 a bushel, how many bushels of wheat can be bought for $\$ 11\frac{1}{3}$?

SOLUTION. — $\$ 11\frac{1}{3} = \$ \frac{34}{3}$. As many bushels can be bought as \$2 is contained times in $\$ \frac{34}{3}$; $\$ \frac{34}{3} \div 2 = \$ 5\frac{2}{3}$.

241. If 6 pounds of coffee cost $\$ 1\frac{1}{2}$, what is the cost per pound?

242. If 4 wagons of the same size together hold $18\frac{3}{4}$ tons of coal, how many tons does each wagon hold?

243. How many times will $16\frac{3}{4}$ gallons of oil fill a vessel that holds 3 gallons?

244. How many oranges, at 4 cents apiece, can be bought for $\frac{2}{3}$ of $\frac{1}{4}$ of 60 cents?

245. At \$4 a yard, how many yards of cloth can be bought for $\$ 21\frac{1}{2}$?

246. If I put 7 dozen shells in a row, how many rows will $38\frac{1}{2}$ dozen shells make?

247. At 5 dimes a gallon, how many gallons of molasses can be bought for $24\frac{3}{4}$ dimes?

248. If a day laborer earns $\$ 8\frac{3}{4}$ in 10 days, how much does he earn in 1 day?

249. If a locomotive runs $4\frac{3}{8}$ miles in 6 minutes, how far does she run in 1 minute?

250. If 12 bushels of oats cost $\$4\frac{1}{2}$, what part of a dollar will 1 bushel cost?

251. If 7 pounds of coffee cost $8\frac{1}{2}$ dimes, how much will 1 pound cost?

252. At $\$ \frac{2}{3}$ a pound, how many pounds of tea can be bought for $\$ \frac{3}{4}$?

SOLUTION. — As many pounds as $\$ \frac{2}{3}$ is contained times in $\$ \frac{3}{4}$. $\frac{2}{3}$ equals $\frac{4}{6}$, $\frac{3}{4}$ equals $\frac{9}{12}$, and 8 twentieths is contained in 15 twentieths $1\frac{1}{2}$ times. Therefore $1\frac{1}{2}$ pounds can be bought.

253. How many pounds of honey, at $\$ \frac{1}{4}$ a pound, can be bought for $\$ \frac{7}{8}$?

254. In $\frac{2}{3}$ of an acre of land, how many building lots are there containing $\frac{3}{10}$ of an acre each?

255. If a horse eats $\frac{3}{8}$ of a bushel of oats in a day, in how many days will he eat $\frac{2}{10}$ of a bushel?

256. If a lamp consumes $\frac{3}{4}$ of a gallon of oil a day, for how long will $\frac{3}{8}$ gallons supply it?

257. If a piece of ribbon $\frac{3}{8}$ of a yard long is cut into pieces $\frac{1}{4}$ of a yard in length, how many pieces will there be?

258. A man, owning $\frac{5}{8}$ of a coal mine, divided his share equally among his sons, giving them $\frac{5}{18}$ each. How many sons had he?

259. Among how many children can you divide $\frac{3}{4}$ of $1\frac{1}{2}$ melons, if you give $\frac{1}{2}$ of $\frac{1}{4}$ of a melon to each?

260. If $\frac{7}{8}$ of a ton of hay is consumed in a stable in one day, for how long will $\frac{5}{8}$ tons be sufficient?

261. At $\frac{4}{5}$ of $\$ \frac{1}{3}$ a yard, how many yards of ribbon can be bought for $\$ \frac{7}{10}$?

262. At $\$ \frac{7}{10}$ a pint, how much oil can be bought for $\$ \frac{1}{2}$?

263. When peaches are worth $\$ \frac{5}{8}$ a bushel, how many can be bought for $\$ \frac{3}{4}$?

264. If $\frac{3}{4}$ of a yard of silk costs \$ $\frac{3}{4}$, how much will 1 yard cost?

SOLUTION. — $\frac{1}{4}$ of a yard will cost $\frac{1}{4}$ of \$ $\frac{3}{4}$, or \$ $\frac{3}{16}$; $\frac{3}{4}$, or a whole yard, will cost $3 \times \$\frac{3}{16} = \$\frac{9}{16} = \$1\frac{1}{4}$.

265. If I pay $\frac{5}{8}$ of a dime for $\frac{5}{8}$ of a dozen eggs, how much will 1 dozen eggs cost?

266. If $\frac{5}{8}$ of a bushel of corn is worth $\frac{1}{4}$ of a bushel of rye, how many bushels of corn is 1 bushel of rye worth?

267. In one bin there was $\frac{5}{8}$ of a bushel of oats, which was $\frac{5}{8}$ of the amount in another bin. How much was there in the second bin?

268. If $\frac{2}{3}$ of a yard of cloth cost \$ $\frac{8}{10}$, how much will 1 yard cost?

269. James ate $\frac{3}{4}$ of a pie, which was $\frac{3}{4}$ of what his brother ate. How much did his brother eat?

270. If $\frac{7}{8}$ of a box of figs costs \$ $\frac{5}{8}$, how much will 1 box cost?

271. How many times can a bottle holding $\frac{1}{4}$ of $\frac{3}{4}$ of a gallon be filled from a demijohn containing $\frac{3}{4}$ of $1\frac{3}{4}$ gallons?

272. A dealer bought $\frac{1}{3}$ of $7\frac{1}{2}$ cords of wood for $\frac{1}{4}$ of \$32. What was the cost per cord?

273. A father divided $113\frac{1}{3}$ acres of land among his 3 sons; to the first he gave $\frac{2}{3}$ of it, and the remainder he divided equally between the other two. How many acres did each receive?

274. If 5 bushels of wheat cost \$9, how much will 1 bushel cost?

SOLUTION. — 1 bushel will cost $\frac{1}{5}$ of \$9 = \$ $\frac{9}{5}$ = \$1 $\frac{4}{5}$.

275. If 6 turkeys are worth \$5, what is the cost of each?

276. If you divide 6 oranges equally among 7 boys, what part of an orange will each receive?

277. If a man travels 29 miles in 9 hours, how far on an average does he travel an hour?

278. If 1 man can build a barn in 20 days, in what time can 3 men build it?

279. If a horse eats 5 bushels of oats in 8 days, what part of a bushel does he eat in 1 day?

280. How much will 1 hat cost, if 4 hats cost \$17?

281. At \$1 $\frac{5}{8}$ a yard, how many yards of cloth can be bought for \$11?

SOLUTION. — As many yards as \$1 $\frac{5}{8}$ is contained times in \$11. \$1 $\frac{5}{8}$ = \$ $\frac{13}{8}$; \$11 = \$ $\frac{88}{8}$, and \$ $\frac{13}{8}$ is contained in \$ $\frac{88}{8}$, 6 times. Therefore 6 yards can be bought.

282. A grocer paid \$4 $\frac{1}{2}$ for some onions, at the rate of \$ $\frac{2}{3}$ a bushel. How many bushels did he buy?

283. How many times will 4 $\frac{3}{4}$ gallons of oil fill a vessel that holds $\frac{1}{2}$ of $\frac{2}{3}$ of 1 gallon?

284. If 4 $\frac{1}{2}$ yards of velvet ribbon cost \$ $\frac{7}{8}$, how much will 1 yard cost?

285. If 3 $\frac{1}{2}$ dozen eggs cost \$ $\frac{7}{16}$, what is the cost of 1 dozen?

286. Several boxes of raisins together weigh 11 pounds. If each box weighs 1 $\frac{3}{8}$ pounds, how many boxes are there?

287. How many yards of flannel, worth \$ $\frac{2}{3}$ a yard, can be exchanged for 6 casks of cider worth \$ $\frac{8}{9}$ apiece?

288. If 1 man can do a piece of work in 6 $\frac{1}{2}$ days, in what time can 4 men do the same work?

NOTE. — Remember that it takes 4 men $\frac{1}{4}$ the time of 1 man.

289. If a man can chop 1 $\frac{1}{2}$ cords of wood in a day, how long will it take him to chop 10 $\frac{1}{2}$ cords?

SOLUTION. — 1 $\frac{1}{2}$ = $\frac{3}{2}$; 10 $\frac{1}{2}$ = $\frac{21}{2}$; $\frac{21}{2} \div \frac{3}{2} = \frac{21}{2} \times \frac{2}{3} = \frac{21}{1} \times \frac{1}{3} = 7$. It will take him 7 days.

290. If $4\frac{1}{8}$ baskets of peaches are worth \$ $3\frac{1}{4}$, how much is 1 basket worth?

291. If $5\frac{1}{8}$ bushels of apples cost \$ $1\frac{1}{5}$, what is the cost of 1 bushel?

292. If a man spends \$ $1\frac{1}{2}$ a month for newspapers, in what time will he spend \$ $10\frac{2}{10}$ for that purpose?

293. At $2\frac{1}{2}$ dimes a pound, how many pounds of camphor can be bought for $9\frac{3}{4}$ dimes?

294. If a stage runs $24\frac{3}{4}$ miles in $3\frac{1}{2}$ hours, how far does it run in 1 hour?

295. Mr. B. distributed $16\frac{1}{2}$ bushels of apples equally among some neighbors, giving them $1\frac{1}{2}$ bushels each. Among how many persons did he distribute them?

296. If a woman can work $3\frac{1}{2}$ dozen buttonholes in 1 day, how many dozen buttonholes can she work in $4\frac{1}{2}$ days?

297. If $6\frac{1}{2}$ pounds of figs cost \$ $1\frac{3}{10}$, how much will 1 pound cost?

298. If two men can build a fence in 18 days, how many days will it take 7 men, working at the same rate, to do it?

299. A horse covered 28 miles in $3\frac{1}{2}$ hours. What was his average rate of speed per hour?

300. If 1 pair of shoes cost \$ $2\frac{3}{8}$, how much will 6 pairs cost?

301. If a pole is $16\frac{1}{2}$ feet long, and $\frac{2}{3}$ of it is above water, what is the length of the pole above water?

302. How much will 6 caps cost at $22\frac{1}{2}$ cents apiece?

303. If 4 cords of wood cost \$14, how much will 5 cords cost?

SOLUTION. — 1 cord will cost $\frac{1}{4}$ of \$14, or $\frac{\$14}{4}$; 5 cords will cost $5 \times \frac{\$14}{4} = \frac{\$70}{4} = \$17\frac{1}{2}$.

304. If 3 bushels of quinces cost \$7, how much will 2 bushels cost?

305. If 9 bushels of apples cost \$4, how much will 7 bushels cost ?

306. At 6 cents for 2 oranges, how many oranges could you buy for 21 cents ?

307. If 4 boys can weed a garden in 15 hours, in what time could 6 boys weed the same garden ?

308. If a quantity of provisions will last 5 men 9 days, how long would the same quantity last 11 men ?

309. If a box holds 19 pounds of soap, how many pounds will there be in $\frac{5}{8}$ of the box ?

310. A barrel of flour was sold for \$8. How much was $\frac{3}{4}$ of it worth ?

311. A farmer sold a cow for \$18, which was only $\frac{2}{3}$ of its value. What was the value ?

312. I paid \$65 to stock a market garden, and then sold the produce for $\frac{3}{4}$ of that sum. How much did I gain ?

313. A farmer, having 80 sheep, sold $\frac{7}{10}$ of them. How many had he left ?

314. If I give 4 pounds of butter, worth $12\frac{1}{2}$ cents a pound, for 8 pounds of sugar, what is the sugar worth a pound ?

315. After paying $\frac{3}{4}$ of my money for a piece of land, I had \$48 left. How much money had I at first ?

316. A man bought a watch and chain for \$50, which was $\frac{7}{8}$ of what the watch alone cost. What was the cost of each ?

317. If a man can cut 9 cords of wood in $\frac{4}{5}$ of a week, how many cords can he cut in 4 weeks ?

318. A man bought a fine picture for \$35; $\frac{3}{4}$ of the cost of the picture was $\frac{3}{4}$ of what he paid for a frame, and $\frac{3}{4}$ of the cost of the frame was $\frac{5}{8}$ of what he paid for the mat and framing. How much did the mat and framing cost him ?

319. If 4 quarts of chestnuts cost 37 cents, how much will 1 bushel cost?

320. If a man can walk 7 miles in 2 hours, how far can he walk in 3 days, by walking 10 hours a day?

321. If $\frac{1}{4}$ of a barrel of flour is worth \$8, how much are 12 barrels worth?

322. If 3 pecks of grass seed cost 15 dimes, how much will 4 quarts cost?

323. If it costs \$19 $\frac{1}{2}$ to put glass in 3 windows, how much will it cost for 7 such windows?

324. If a man earns \$32 $\frac{1}{2}$ in 4 weeks, how much will he earn in 2 weeks?

325. If \$9 will buy 4 $\frac{1}{2}$ yards of cloth, how much will \$1 buy?

326. A hardware dealer had 56 $\frac{1}{2}$ pounds of a certain kind of nails and sold $\frac{2}{3}$ of them. How many had he left?

327. If 9 horses eat 5 $\frac{1}{2}$ bushels of oats in a day, how many bushels will 4 horses eat in the same time?

328. If 3 yards of flannel cost \$ $\frac{5}{8}$, how much will 8 yards cost?

329. If 10 bushels of wheat are worth 22 $\frac{1}{2}$ bushels of corn, how many bushels of corn are 3 bushels of wheat worth?

330. If 14 acres of meadow land produce 32 $\frac{1}{2}$ tons of hay, how many tons will 5 acres of the same land produce?

331. A cistern is filled by 3 pipes in 6 $\frac{1}{2}$ hours. How many pipes of the same size will be required to fill it in $\frac{1}{4}$ of an hour?

332. A boy sold 5 quarts of strawberries at the rate of 3 quarts for 13 cents. How much did he receive for them?

333. A tailor bought 3 pieces of cloth, each piece containing 6 $\frac{3}{4}$ yards, for \$48 $\frac{1}{4}$. How much did it cost a *piece*, and how much a yard?

334. If a pole 8 feet long casts a shadow 6 feet in length, how long is a pole that casts a shadow $12\frac{1}{2}$ feet in length at the same time in the same place?

335. How much less than \$17 will 9 yards of satin cost, if 2 yards cost $\$3\frac{1}{4}$?

336. If 3 yards of velvet cost $\$5\frac{1}{4}$, how much more than \$9 will 6 yards of it cost?

337. If a horse travels $40\frac{2}{3}$ miles in 6 hours, how far will he travel in 4 hours?

338. If 5 pounds of chalk cost $28\frac{1}{2}$ cents, how much will $\frac{3}{4}$ of a pound cost?

339. If 3 pairs of socks cost $\$ \frac{9}{10}$, how many pairs can be bought for $\$2\frac{7}{10}$?

340. Henry is $\frac{3}{4}$ as old as his father, who is 60 years of age. What is Henry's age?

341. If there are $2\frac{1}{2}$ dozen squares in a piece of oilcloth $\frac{1}{4}$ of a yard long, how many will there be in a piece $\frac{5}{8}$ of a yard long?

342. A boy sold some peaches for $6\frac{3}{4}$ cents, at the rate of 3 for $4\frac{1}{2}$ cents. How many did he sell?

343. If 7 bushels of oats cost $\$1\frac{1}{5}$, how much will $12\frac{3}{4}$ bushels cost?

344. If $2\frac{5}{8}$ yards of silk cost $\$4\frac{1}{5}$, how much will 5 yards cost?

345. I bought $4\frac{1}{2}$ barrels of cider at $\$3\frac{4}{5}$ a barrel, and paid for it in wood at \$3 a cord. How many cords of wood paid for the cider?

346. In one bank there are $\$5\frac{1}{2}$, and in another $1\frac{1}{2}$ times as much. How much is there in the second bank?

347. Three men incur an expense of $\$27\frac{2}{3}$. How much more than $\$7\frac{1}{2}$ must each pay?

348. A man, being asked his age, said that were he 3 times as old, $\frac{1}{2}$ of his age would be 8 years. How old was he?

349. If a pound of tea is worth $1\frac{1}{2}$ times as much as a pound of coffee, how much will $6\frac{2}{3}$ pounds of coffee cost, when tea is worth 50 cents a pound?

350. If $2\frac{3}{4}$ pounds of cheese cost 20 cents, how much will 12 pounds cost?

351. If $3\frac{1}{4}$ barrels of apples cost \$ $5\frac{1}{2}$, how much will $\frac{1}{2}$ barrel cost?

352. A stone mason worked $11\frac{3}{4}$ days, and after paying for his board and for other expenses with $\frac{3}{7}$ of his earnings, he found he had \$20 left. How much did he receive a day?

353. If 7 bushels of potatoes cost \$ $5\frac{1}{2}$, how many bushels can be bought for \$ $14\frac{1}{2}$?

354. If $\frac{1}{3}$ of a quart of bay rum costs \$ $\frac{3}{4}$, how many gallons will \$ $12\frac{3}{4}$ buy?

355. How many yards of silk can be bought for \$30, if $\frac{2}{3}$ of a yard costs \$3?

356. If $\frac{4}{5}$ of a dime will buy $\frac{2}{3}$ of a pound of butter, how many pounds will 7 dimes buy?

357. How many gallons of molasses can be bought for \$ $3\frac{1}{2}$, if $\frac{1}{3}$ of a gallon costs \$ $\frac{1}{4}$?

358. How many palms can be bought for \$10, if 9 palms cost \$24?

359. If 5 dozen eggs cost $12\frac{1}{2}$ dimes, how many dozen can be bought for 7 dimes?

360. If 8 yards of velvet ribbon cost \$ $1\frac{7}{8}$, how many yards can be bought for \$ $3\frac{1}{2}$?

361. How many pints of alcohol will 3 dimes buy, if $\frac{1}{3}$ of a pint costs $\frac{1}{4}$ of a dime?

362. If a man eats $1\frac{2}{3}$ loaves of bread in a day, how many days will $22\frac{1}{3}$ loaves last him?

363. How many pounds of sugar worth 10 cents a pound can be had in exchange for $6\frac{2}{3}$ pounds of cheese worth $7\frac{1}{2}$ cents a pound?

364. If a horse consumes $8\frac{1}{4}$ bushels of oats in 3 weeks, how many bushels will he consume in 5 weeks?

365. A man gave $6\frac{3}{4}$ pounds of butter at 12 cents a pound for $\frac{4}{5}$ of a gallon of oil. What was the price of the oil per gallon?

366. When 4 pounds of tea can be bought for \$2 $\frac{2}{3}$, how much can be bought for \$1 $\frac{2}{3}$?

367. A man, having \$10, gave $\frac{3}{4}$ of his money for clover seed at \$3 $\frac{1}{3}$ a bushel. How many bushels did he buy?

368. If $\frac{5}{8}$ of a bushel of rye costs \$ $\frac{1}{2}$, how many bushels can be bought for \$7?

369. If $\frac{1}{2}$ a yard of cloth costs \$ $\frac{3}{5}$, how much will $\frac{7}{8}$ of a yard cost?

370. If $\frac{3}{4}$ of 2 pounds of tea costs \$1 $\frac{1}{2}$, how much will $\frac{4}{5}$ of 1 pound cost?

371. How much will $\frac{4}{5}$ of a barrel of apples cost, if $\frac{3}{4}$ of a barrel costs \$ $\frac{2}{3}$?

372. If $\frac{7}{8}$ of one plot of ground is $\frac{7}{8}$ as large as another plot, how many times the second plot is $1\frac{1}{4}$ times the first plot?

373. What will be the cost of 6 barrels of flour at the rate of \$2 $\frac{2}{3}$ for every $\frac{2}{3}$ of a barrel?

374. At \$ $\frac{1}{6}$ a quart, what part of a bushel of clover seed can be bought for \$3 $\frac{1}{2}$?

375. A farmer going to market lost $\frac{1}{3}$ of his money. Afterwards he gained \$75, and then found that he had \$375. How much money did he lose?

376. If 4 horses consume 2 $\frac{3}{4}$ bushels of oats in 2 $\frac{1}{2}$ days, how many bushels will 6 horses consume in the same time?

377. If $\frac{3}{4}$ of a bushel of barley is given in exchange for $\frac{3}{4}$ of a bushel of corn worth \$ $\frac{2}{3}$ a bushel, what is the barley worth a bushel?

378. I picked 35 pinks, and then had $\frac{4}{5}$ of all my pinks left growing. How many pinks had I at first?

379. If \$40 is \$10 more than $\frac{1}{2}$ of $\frac{3}{4}$ of what I gained in the sale of a house and lot, how much did I gain?

380. If I pay \$5 $\frac{1}{2}$ for $\frac{2}{3}$ of 4 tons of coal, how much will $\frac{3}{4}$ of 2 tons cost?

381. 5 times $\frac{1}{3}$ of 30 is 4 less than 3 times the number of trees in a garden. How many trees are there in the garden?

382. In an orchard $\frac{1}{2}$ the trees bear apples, $\frac{1}{4}$ bear peaches, $\frac{1}{8}$ bear pears, and 15 trees bear plums. How many trees are there in the orchard, and how many of each kind?

383. How many yards of cloth, $\frac{4}{5}$ of a yard wide, are equal to 12 yards of cloth $\frac{3}{4}$ of a yard wide?

384. Mary, Jane, and Kate can peel a certain quantity of quinces in 5 hours. Jane and Kate together can do it in 8 hours. In what time could Mary do it alone?

385. A can build a piece of wall in 3 days, and B can build it in 4 days. In what time can both together build it?

386. If $\frac{2}{3}$ the value of a carriage is equal to $\frac{3}{4}$ the value of a horse, and the difference in their values is \$25, what is the value of each?

387. A tailor paid \$77, which was $\frac{7}{12}$ of all the money he had, for cloth, at the rate of \$3 a yard. How many yards could he have purchased with all his money, at the same rate?

388. A father divided a piece of land among his 3 sons. To the first he gave 10 $\frac{1}{2}$ acres, to the second $\frac{2}{3}$ of the whole, and to the third as much as to the other two. How many acres did each receive?

389. A farmer bought 2 cows for \$56, paying $\frac{3}{4}$ as much for one as for the other. How much did each cost?

390. Mary and Ann can dust a room in 14 minutes. Mary can do $\frac{3}{4}$ as much as Ann. How long would it take each of them to do it alone?

391. I used $\frac{7}{8}$ of a yard of lace, which was $\frac{3}{4}$ of what I had bought. How many yards had I bought?

392. A man bought a sleigh for \$50, which was $\frac{2}{3}$ of 3 times the sum paid for a harness. What was the cost of the harness?

393. A lady bought a fur cape for \$90, which was $\frac{1}{8}$ of what she paid for 12 yards of silk. What was the cost of the silk a yard?

394. A merchant sold 5 barrels of flour for \$32 $\frac{1}{2}$, which was $\frac{5}{8}$ of what he received for the remainder of his barrels, which he sold at \$4 a barrel. How many barrels did he sell in all?

395. James paid 56 cents for a pair of skates, which was $\frac{4}{5}$ of what he paid for his sled. How much did his sled cost him?

396. A farmer paid \$23 $\frac{1}{2}$ for a cow, which was $\frac{1}{2}$ of what he received for a horse. What was the difference in the price of the cow and the horse?

397. A man sold 4 $\frac{1}{2}$ cords of wood at \$2 $\frac{1}{2}$ a cord, which was $\frac{2}{3}$ of what he received for a ton of hay. How much did he receive for the hay?

398. A coal merchant sold $\frac{2}{3}$ of the coal he had on hand for \$90, at the rate of \$6 a ton. How many tons had he?

399. A music teacher bought a piano for \$300, and $\frac{2}{3}$ of the cost of the instrument was $\frac{4}{5}$ of what he received for teaching 9 pupils one term. How much did each pupil pay?

400. The tools in a shop are worth \$80. $\frac{2}{3}$ of this is $\frac{3}{4}$ of $\frac{1}{2}$ of twice the value of the stock. What is the value of the stock?

401. A peddler, after selling \$200 worth of his stock in trade, finds that $\frac{5}{7}$ of the remainder is equal to $\frac{5}{8}$ of 3 times the amount sold. What amount of stock had he at first?

402. A merchant, after selling from a barrel of oil 15 gallons more than $\frac{1}{3}$ of the whole, found that the number of gallons left was just 3 times the number of gallons sold. How many gallons did the cask contain at first?

403. If a store is worth \$1000, and $\frac{4}{5}$ of the value of the store is equal to $\frac{3}{5}$ of $2\frac{1}{2}$ times the value of the goods it contains, what is the value of the goods?

404. Two boys had saved money. The elder had 50 cents, and when he asked his brother how much there was in his bank, the younger replied, " $\frac{7}{10}$ of your money is $\frac{5}{12}$ of 6 times my money." How much had the younger brother saved?

405. A man, being asked his age, answered that if he were 3 times as old as he was, $\frac{1}{4}$ of his age would be 24 years. How old was he?

406. A man pays \$400 rent, and $\frac{3}{4}$ of this is just $\frac{3}{4}$ of $\frac{1}{2}$ of twice his annual income. What is his annual income?

407. A boy, being asked his age, said that 18 years was 2 years less than $\frac{3}{4}$ times $\frac{5}{8}$ of his age. How old was he?

408. Mr. B., who is 64 years of age, is $2\frac{2}{3}$ times as old as his eldest son, and his eldest son is $2\frac{2}{3}$ times as old as his youngest brother. What is the difference in the ages of the two brothers?

409. James had 50 cents; Henry had 4 less than $\frac{4}{5}$ as much, and William had 7 more than $\frac{3}{4}$ as much as Henry. How much money had Henry and William?

410. A man put his money into 4 packages; in the first he put $\frac{2}{5}$, in the second $\frac{1}{5}$, in the third $\frac{1}{5}$, and in the fourth \$24. How much money had he altogether?

411. Mrs. D.'s coat cost \$30; $\frac{4}{5}$ of the cost of the coat was $\frac{5}{6}$ of 6 times the cost of her hat. What was the cost of her hat?

412. B had $\frac{2}{3}$ as much money as C. By working for him, C earned \$16 of B's money, which was $\frac{2}{3}$ of $1\frac{1}{2}$ times what C had before. How much did C have at first, and how much did B have left after paying C his wages?

413. A farmer, being asked how many sheep he had, replied that he had just sold 150, and that $\frac{4}{5}$ the number he had sold was 6 times $\frac{2}{3}$ of what he had left. How many had he left?

414. Mr. S. gave $\frac{2}{3}$ of $1\frac{1}{2}$ times his ready money for a buggy, $\frac{3}{4}$ of what was left for a harness, and had \$12 remaining. How much did he pay for the buggy?

415. A paid \$4800 for his farm; $\frac{3}{4}$ of this is $4\frac{1}{2}$ times $\frac{4}{5}$ of twice what it cost to build the house. What was the cost of the house?

416. How much will 5 pounds of coffee cost at $33\frac{1}{8}$ cents a pound?

SOLUTION. — $33\frac{1}{8}\text{¢} = \$\frac{1}{8}$. $5 \times \$\frac{1}{8} = \$\frac{5}{8} = \$1\frac{1}{8} = \$1.66\frac{2}{3}$.

417. At $12\frac{1}{2}$ cents a yard, how much will 6 yards of lawn cost?

418. If 7 yards of ribbon cost $87\frac{1}{2}$ cents, how much will 1 yard cost?

419. I spent $\$ \frac{3}{4}$ for dry goods, $\$ \frac{1}{2}$ for cake, and $\$ \frac{1}{4}$ for fruit. How much did I spend altogether?

420. At $\$ \frac{3}{4}$ a pair, how much will 7 pairs of gloves cost?

421. At the rate of 2 yards for $11\frac{1}{2}$ cents, how many yards of ribbon can I buy for \$1?

422. Find the cost of 20 yards of ribbon at $16\frac{2}{3}$ cents a yard.

DECIMAL FRACTIONS.

97. Decimal Fractions or Decimals are fractions which have for their denominator 10, 100, 1000, or 1 with any number of ciphers annexed. They are the divisions of a unit into 10ths, 100ths, 1000ths, etc., just as common fractions are the divisions into halves, thirds, fourths, etc.

Thus, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, are decimals or decimal fractions.

98. Since the denominators of decimal fractions increase and decrease by tens, like simple numbers, in writing decimals the denominator may be omitted.

99. The **Sign of Decimals** is a period (.), called a *decimal point* which is placed at the left of the decimal.

100. The relation of decimals and integers is clearly shown in the following table:

Read as follows, always using the word *and* between the integer and decimal:

425 and 37 *hundredths*.

1046 and 65 *thousandths*.

32400 and 456 *thousandths*.

87 and 75 *ten-thousandths*.

4328 and 169 *thousandths*.

7000 and 7 *ten-thousandths*.

Ten-thousandths.	Thousands.	Hundreds.	Tens.	Units.	.	Tenths.	Hundredths.	Thousandths.	Ten-thousandths.
		4	2	5	.	3	7		
	1	0	4	6	.	0	6	5	
3	2	4	0	0	.	4	5	6	
			8	7	.	0	0	7	5
	4	3	2	8	.	1	6	9	
	7	0	0	0	.	0	0	0	7
INTEGERS.						DECIMALS.			

101. Read the following numbers :

1. .7	11. .6	21. 5.5
2. .07	12. .67	22. 50.05
3. .77	13. .008	23. 55.55
4. .007	14. .327	24. 500.005
5. .077	15. .6489	25. 550.055
6. .777	16. .075	26. 555.555
7. .027	17. .673	27. 600.006
8. .037	18. .4859	28. 660.066
9. .099	19. .0039	29. 666.666
10. .999	20. .0476	30. 999.999

31. Express in decimal form $\frac{9}{100}$.

SOLUTION. — Every decimal must contain as many figures as there are ciphers in the denominator of the common fraction. Since 100 contains two ciphers there must be two decimal figures, and since the numerator is 9 we must *prefix* a cipher, thus .09.

In like manner, analyze and express :

32. $\frac{9}{10}$	35. $\frac{42}{100}$	38. $\frac{14}{100}$	41. $\frac{20}{100}$
33. $\frac{24}{100}$	36. $\frac{125}{1000}$	39. $\frac{7}{1000}$	42. $\frac{8}{1000}$
34. $\frac{4}{100}$	37. $\frac{22}{1000}$	40. $\frac{102}{1000}$	43. $\frac{30}{1000}$

44. What is the sum of 13.07, 7.8, and .31 ?

SOLUTION. — We must place the units of the same order in the same column and add as in whole numbers, placing the decimal point of the sum directly under the decimal points of the numbers added. Since ciphers added to the right of a decimal do not alter its value, we may add as many as convenient in performing any operation.

$$\begin{array}{r}
 13.07 \\
 7.80 \\
 .31 \\
 \hline
 21.18
 \end{array}$$

Add the following :

45.	46.	47.	48.
42.3	12.326	4031.06	.608
13.06	204.09	108.304	.031
8.049	8.302	9.031	.803
1.6	52.007	76.739	.086
<u>.037</u>	<u>324.1</u>	<u>250.046</u>	<u>.910</u>

49. $400.327 + 64.03 + .846 + 120.8 + 7.42 = ?$

50. $\$ 18.19 + \$ 142.095 + \$.96 + \$ 5.12 + \$ 40.50 = ?$

51. From 7.63 subtract 5.4.

SOLUTION. — We must place the units of the same order in the subtrahend directly under those in the minuend, and subtract as in whole numbers, placing the decimal point in the remainder directly below the decimal points in the minuend and subtrahend.

7.63
5.40
2.23

Solve and prove the following :

	52.	53.	54.	55.
From	18.5	2.8706	.50376	.36
Subtract	<u>2.3476</u>	<u>.49</u>	<u>.064</u>	<u>.127084</u>

56. $327.64 - 104.36 = ?$ 58. $610.324 - 84.036$

57. $125.75 - 41.48 = ?$ 59. $500.50 - 75.45$

Multiply each of the following numbers rapidly, first by 10, then by 100 :

Thus, 3, 30 ; 4, 40 ; .5, 5 ; 4.25, 42.5, etc.

60. .3	67. .2	74. .6	81. .2
61. .4	68. .9	75. .3	82. .44
62. .05	69. .08	76. .09	83. .59
63. .425	70. .750	77. .506	84. .505
64. .275	71. .742	78. .246	85. .555
65. .665	72. .443	79. .284	86. .550
66. .2342	73. .1094	80. .7631	87. .2314

88. Multiply .56 by .4.

SOLUTION. — We multiply as in whole numbers, and since *hundredths* multiplied by *tenths* produces *thousandths*, the product must contain *three* decimal places, or as many as both factors contain.

$$\begin{array}{r} .56 \\ .4 \\ \hline .224 \end{array}$$

First name the number of decimal places in each product. Then give the products :

89. $.07 \times 9.9$	95. $.33 \times 6.2$	101. $4.25 \times .005$
90. $6 \times .05$	96. $.003 \times 10$	102. $1.361 \times .04$
91. $3 \times .006$	97. 1.25×100	103. $.425 \times .25$
92. $4 \times .05$	98. 12×30.5	104. $6 \times .0002$
93. $.07 \times .002$	99. 5×3.14	105. $4 \times .625$
94. $.5 \times .30$	100. 4.5×3.09	106. $.321 \times .004$

	107.	108.	109.	110.
Multiply	4.6	43.26	.234	75.1
By	<u>.3</u>	<u>1.2</u>	<u>.03</u>	<u>.11</u>

111. Divide 3.333 by 1.1.

SOLUTION. — The quotient must contain as many decimal places as the number of decimal places in the dividend exceeds those in the divisor.

$$\begin{array}{r} 1.1 \overline{)3.333} \\ 3.03 \end{array}$$

Divide by 10, 100, and 1000 :

112. 327	115. 340	118. 15.25	121. 4.132
113. 506	116. 56.5	119. 16.75	122. 16.125
114. 825	117. 43.2	120. 3.475	123. 15.132

Name the quotients :

124. $16.4 \div 4$	127. $3.76 \div .8$	130. $4.8 \div 1.2$
125. $2.25 \div 9$	128. $.624 \div .6$	131. $1.243 \div .11$
126. $.675 \div .15$	129. $.9520 \div .7$	132. $645.5 \div 5$

Divide:

133. 8.176 by 7

136. \$41.47 by 1.3

134. 4.65 by .15

137. 3.76 by .8

135. \$26.64 by 8

138. 17.6 by 44

139. Reduce $\frac{3}{8}$ to a decimal.

SOLUTION. — $\frac{3}{8} = 3 \div 8$. Performing the division, $8 \overline{)3.000}$
the result is .375.

Reduce to decimals:

140. $\frac{1}{2}$ 142. $\frac{2}{3}$ 144. $\frac{3}{4}$ 146. $\frac{5}{6}$ 148. $\frac{7}{8}$ 150. $\frac{9}{10}$

141. $\frac{1}{4}$ 143. $\frac{1}{5}$ 145. $\frac{5}{8}$ 147. $\frac{4}{5}$ 149. $\frac{3}{5}$ 151. $\frac{2}{3}$

152. Memorize the following equivalents and compare with the table on page 107:

$\frac{1}{2} = .50$

$\frac{2}{3} = .80$

$\frac{3}{4} = .85\frac{1}{2}$

$\frac{5}{6} = .55\frac{5}{6}$

$\frac{1}{3} = .33\frac{1}{3}$

$\frac{1}{5} = .16\frac{2}{3}$

$\frac{1}{6} = .12\frac{1}{2}$

$\frac{7}{8} = .77\frac{7}{8}$

$\frac{2}{3} = .66\frac{2}{3}$

$\frac{5}{6} = .83\frac{1}{3}$

$\frac{3}{8} = .37\frac{1}{2}$

$\frac{5}{6} = .88\frac{5}{6}$

$\frac{1}{4} = .25$

$\frac{1}{7} = .14\frac{2}{7}$

$\frac{5}{8} = .62\frac{1}{2}$

$\frac{1}{11} = .09\frac{1}{11}$

$\frac{3}{4} = .75$

$\frac{2}{7} = .28\frac{4}{7}$

$\frac{7}{8} = .87\frac{1}{2}$

$\frac{1}{12} = .08\frac{1}{3}$

$\frac{1}{5} = .20$

$\frac{3}{7} = .42\frac{6}{7}$

$\frac{1}{9} = .11\frac{1}{9}$

$\frac{1}{15} = .06\frac{2}{3}$

$\frac{2}{5} = .40$

$\frac{4}{7} = .57\frac{1}{7}$

$\frac{2}{9} = .22\frac{2}{9}$

$\frac{1}{10} = .05$

$\frac{3}{5} = .60$

$\frac{5}{7} = .71\frac{4}{7}$

$\frac{4}{9} = .44\frac{4}{9}$

$\frac{1}{15} = .04$

Give the decimal equivalents of:

153. $\frac{2}{5}, \frac{3}{5}, \frac{1}{4}, \frac{1}{5}, \frac{2}{7}, \frac{4}{5}, \frac{3}{10}, \frac{5}{10}, \frac{3}{7}, \frac{5}{8}, \frac{5}{8}, \frac{1}{2}, \frac{1}{3}, \frac{2}{3}$

154. $\frac{1}{5}, \frac{2}{5}, \frac{4}{5}, \frac{1}{6}, \frac{5}{6}, \frac{1}{7}, \frac{7}{6}, \frac{1}{11}, \frac{2}{7}, \frac{1}{12}, \frac{5}{7}, \frac{1}{15}, \frac{7}{15}, \frac{1}{15}$

155. Reduce .145 to a common fraction.

SOLUTION. — $.145 = \frac{145}{1000} = \frac{29}{200}$.

Reduce to common fractions :

156. $.33\frac{1}{3}$	164. $.50$	172. $.66\frac{2}{3}$	180. $.05$
157. $.60$	165. $.14\frac{2}{7}$	173. $.25$	181. $.37\frac{1}{2}$
158. $.16\frac{2}{3}$	166. $.06\frac{1}{4}$	174. $.85\frac{5}{8}$	182. $.22\frac{2}{3}$
159. $.83\frac{1}{3}$	167. $.42\frac{2}{7}$	175. $.08\frac{1}{8}$	183. $.80$
160. $.75$	168. $.20$	176. $.40$	184. $.04$
161. $.44\frac{4}{9}$	169. $.57\frac{1}{7}$	177. $.28\frac{4}{7}$	185. $.11\frac{1}{9}$
162. $.77\frac{2}{3}$	170. $.71\frac{1}{7}$	178. $.12\frac{1}{2}$	186. $.87\frac{1}{2}$
163. $.09\frac{1}{11}$	171. $.55\frac{5}{8}$	179. $.88\frac{3}{4}$	187. $.62\frac{1}{2}$

Reduce to improper fractions :

188. $1.33\frac{1}{3}$	191. 3.75	194. $8.11\frac{1}{9}$	197. $3.83\frac{1}{3}$
189. $2.62\frac{1}{2}$	192. $5.71\frac{1}{7}$	195. $10.16\frac{2}{3}$	198. $2.66\frac{2}{3}$
190. $9.12\frac{1}{2}$	193. $6.14\frac{2}{7}$	196. $9.87\frac{1}{2}$	199. 11.04

PROBLEMS.

102. 1. How many acres of land are there in 4 farms containing, respectively, 40.3 acres, 120.75 acres, $142.62\frac{1}{2}$ acres, and 60.375 acres ?

2. How many yards of cloth are there in 3 pieces, the first containing $21\frac{1}{2}$ yards, the second, $36\frac{3}{4}$ yards, and the third, 40.15 yards ?

3. A man owns 4 lots containing $32\frac{1}{4}$, $36\frac{3}{8}$, $40\frac{5}{8}$, and 49.625 rods, respectively. How many rods does he own in all ?

4. A man paid bills as follows : \$ 3.97, \$ 4.56, \$ 2.39, and \$ 3.50. How much did he pay in all ?

5. A man owned $.54$ of an acre of land and sold $\frac{1}{2}$ an acre. How much had he left ?

6. A bicyclist traveled on his wheel 25.25 miles the first day, and 10.75 miles the second day. How much farther did he travel the first day than the second?

7. A boy who earned \$7.75 a week spent \$2.30 of it every week. How much did he save in 6 weeks?

8. A man having \$1000 in bank drew out \$450.62. How much remained in bank?

9. If a cord of wood is worth 2.37 bushels of wheat, how many bushels of wheat must be given for 1.2 cords of wood?

10. A lady bought 1.1 yards of silk at \$3.75 a yard, and 2.2 yards of cloth at \$.75 a yard. How much more did the silk cost than the cloth?

11. At \$237.25 an acre, how much will 1.2 acres of land cost?

12. At \$5.87½ a ream, how much will 7 reams of paper cost?

13. At \$.40 a dozen, how much will 60 buttons cost?

14. If a man travels 12.2 miles a day, how long will it take him to travel 244 miles?

15. If a man builds 812.50 rods of fence in 100 days, how many rods does he build each day?

16. If 3 yards of ribbon cost \$.37½, how much will 1 yard cost?

17. I paid \$.87½ for 7 yards of calico. What was the cost per yard?

18. If 8 dozen glasses cost \$37, what is the price per dozen? The price of each glass?

19. How many yards of gingham can be bought for \$16 at \$.25 a yard? at \$.66⅔? at \$.33⅓? at .37½?

20. At \$56 an acre, how much will 1.25 acres of land cost?

21. Mr. A earns \$25.50 every week and his expenses average \$2.50 a day. How much does he save in a week?

22. If a cord of wood is worth 2.84 bushels of wheat, how many bushels of wheat must be given for 2.5 cords of wood ?

23. A man bought a farm for \$ 1575.24, and sold it for \$ 1834.16; how much did he gain ?

24. A merchant bought flour for \$ 5.62 $\frac{1}{2}$ a barrel, and sold it for \$ 6.87 $\frac{1}{2}$ a barrel; how much did he gain on a barrel ?

25. A man, having \$ 14725, paid \$ 3560 for a store, and \$ 7015.87 $\frac{1}{2}$ for goods; how much money had he left ?

26. A man paid for building a house \$ 2175.75, for painting the same \$ 240.37 $\frac{1}{2}$, for furniture \$ 605.40, for carpets \$ 140.12 $\frac{1}{2}$; what was the cost of the house and furnishing ?

27. I bought a hat for \$ 3.62 $\frac{1}{2}$, a pair of shoes for \$ 1 $\frac{3}{4}$, an umbrella for \$ 1 $\frac{3}{8}$, a pair of gloves for \$.62 $\frac{1}{2}$, and a cane for \$.87 $\frac{1}{2}$; what was the cost of all my purchases ?

28. A man owned thirty-four hundredths of a township of land, and sold thirty-four thousandths of the township; how much did he still own ?

29. A grocer bought 50 pounds of cheese at \$.15 a pound, 400 pounds of coffee at \$.12 $\frac{1}{2}$ a pound, and 15 bushels of potatoes at \$.33 $\frac{1}{8}$ a bushel; what was the cost of all ?

30. Traveling at the rate of 4 $\frac{3}{4}$ miles an hour, how many hours will a man require to travel 46.46 miles ?

31. If 33 gallons of oil cost \$ 36.30, what is the cost per gallon ?

32. If 1 pound of tea costs \$.54, how many pounds can be bought for \$ 432 ?

33. A farmer sells 120 bushels of wheat at \$ 1.12 $\frac{1}{2}$ a bushel, for which he receives 27 barrels of flour; how much does the flour cost him a barrel ?

RATIO AND PROPORTION.

103. A **Ratio** is the relation between two numbers expressed as the quotient of the first divided by the second.

Thus the ratio of 6 to 3 is $6 \div 3 = 2$.

104. The **Sign of Ratio** is a colon.

Thus the ratio of 6 to 3 is written $6 : 3$.

105. The **Terms of a Ratio** correspond to a dividend and divisor. The former is called the **Antecedent**, and the latter the **Consequent**.

Thus, in $6 : 2$, 6 is the *antecedent*, and 2 the *consequent*.

106. The **Value of a Ratio** is the *quotient* of the antecedent divided by the consequent.

Thus in $6 : 2$, the value of the ratio is $6 \div 2$, or 3.

107. A **Proportion** is an equality of ratios.

Thus $3 : 6$ as $6 : 12$, or $3 : 6 = 6 : 12$ is a proportion.

108. The **Sign of Proportion** is $::$, a double colon.

Thus $3 : 6$ as $6 : 12$ is written $3 : 6 :: 6 : 12$.

109. 1. What part of 4 is 1? of 4 is 3?

SOLUTION. — Since 1 is $\frac{1}{4}$ of 4, 3 must be $3 \times \frac{1}{4}$ of 4, or $\frac{3}{4}$ of 4.

2. What part of 3 is 1? of 3 is 2?
3. What part of 7 is 1? of 5 is 3?
4. What part of 8 is 2? of 9 is 5?
5. What part of 10 is 7? of 13 is 9?
6. What part of 8 is 9? of 12 is 7?
7. What part of 16 is 11? of 20 is 17?
8. What part of 40 is 9? What is the ratio?
9. What part of 30 is 27? What is the ratio?
10. What part of $\frac{4}{5}$ is $\frac{2}{5}$? What is the ratio?

SOLUTION. — $\frac{4}{5} = \frac{1}{5}$, and $\frac{2}{5} = \frac{1}{5}$; the ratio of $\frac{1}{5}$ to $\frac{1}{5}$ is the same as that of their numerators, 10 to 12. What part of 12 is 10? $\frac{10}{12} = \frac{5}{6}$. The ratio = $\frac{5}{6}$.

11. What part of $\frac{3}{4}$ is $\frac{1}{4}$? of $\frac{3}{4}$ is $\frac{1}{4}$?
12. What part of $\frac{7}{8}$ is $\frac{3}{8}$? of $\frac{9}{10}$ is $\frac{1}{2}$?
13. What part of $\frac{6}{7}$ is $\frac{5}{7}$? of $\frac{6}{11}$ is $\frac{2}{11}$?
14. What part of $\frac{7}{12}$ is $\frac{2}{3}$? of $\frac{4}{5}$ is $\frac{2}{5}$?
15. What part of $\frac{9}{14}$ is $\frac{3}{7}$? What is the ratio?
16. What part of 5 is $\frac{2}{3}$? What is the ratio?
17. What part of 7 is $\frac{5}{6}$? of $3\frac{1}{2}$ is 2?
18. What part of $4\frac{1}{3}$ is $\frac{5}{3}$? of $7\frac{1}{2}$ is $3\frac{1}{4}$?
19. What part of $\frac{8}{9}$ is 2? of $2\frac{2}{3}$ is $1\frac{2}{3}$?
20. What part of $\frac{7}{10}$ is 5? of $\frac{8}{9}$ is 6?
21. What part of \$25 is \$5?
22. What part of 16 pounds is 4 pounds? 7 pounds? 12 pounds?
23. What part of 1 bushel is 1 peck? 2 pecks and 4 quarts? 6 quarts?
24. What part of 1 pound is 12 shillings?
25. What part of 1 dollar is 20 cents? 5 dimes?
26. What part of 1 cwt. is 15 pounds?
27. What part of 1 cwt. is 6 pounds? 9 pounds?
28. What part of 1 ton is 14 cwt.? 15 cwt.? 18 cwt.?
29. What part of 3 pounds Troy is 10 ounces?
30. What part of 1 foot is 3 inches? 10 inches?

31. What part of 2 yards is 1 foot 10 inches ?
32. What part of 1 mile is 8 rods ?
33. What part of 1 mile is 140 rods ? 160 rods ?
34. What part of 1 gallon is 1 quart ? 1 pint ?
35. What part of 5 gallons is 1 quart ?
36. What part of 1 quart is 1 pint ? 2 gills ?
37. What part of 1 hour is 15 minutes ? 40 minutes ?
38. What part of 1 day is 3 hours ? 8 hours ? 16 hours ?
39. What part of 3 weeks is 2 days ? 5 days ? 9 days ?
40. What part of 1 year is 3 weeks ? 7 weeks ?
41. What part of 5 pounds 6 ounces Troy is 3 pounds 10 ounces ?
42. What part of 1 mile is 20 rods ?
43. What part of 3 pecks is 6 quarts 1 pint ?
44. Two pounds is what part of 1 cwt. ? of 2 cwt. ?
45. Eight inches is what part of a foot ? of 2 feet ? of 1 yard ? of 4 yards ?
46. Three quarts is what part of a gallon ?
47. What part of 9 miles is $\frac{3}{4}$ of 8 miles ?
48. What part of $4\frac{1}{2}$ acres is $\frac{1}{3}$ of $3\frac{1}{4}$ acres ?
49. What part of $3\frac{1}{2}$ dozen is $\frac{1}{4}$ of 2 dozen ?
50. What part of $3\frac{1}{8}$ weeks is $\frac{1}{3}$ of $7\frac{1}{2}$ weeks ?
51. What part of $8\frac{1}{4}$ pecks is $\frac{1}{4}$ of 6 pecks ?

PROBLEMS.

110. 1. A baker, having 15 pounds of cake, sold $3\frac{1}{2}$ pounds to one customer, and $4\frac{1}{4}$ pounds to another. What part of his cake did he sell, and what part had he left ?
2. A farmer, having 160 bushels of wheat, sold $\frac{1}{2}$ of $\frac{3}{4}$ of it, used $\frac{2}{5}$ of $\frac{7}{8}$ of it, and kept the remainder for seed. What part of the whole did he use for each purpose ?

3. If I have sold $\frac{3}{4}$ of $\frac{1}{2}$ of 120 sheep, what part of the whole flock have I left?

4. One train can go $4\frac{3}{4}$ miles, while another goes $3\frac{3}{4}$ miles. What part of the distance that the first goes does the second go?

5. A man paid $\frac{5}{7}$ of \$39 $\frac{1}{2}$ for a desk, and \$9 $\frac{1}{2}$ for a chair. How many times as much did he pay for the desk as for the chair?

6. It took a man $7\frac{2}{3}$ months to do a certain piece of work, and $1\frac{1}{2}$ times as long for his next undertaking. How long did the second piece of work take him?

7. A man bought a horse for \$225, and a harness for $\frac{1}{3}$ of $\frac{3}{5}$ of that sum. What part of \$125 did the harness cost?

8. If a vessel sails 40 miles in 5 hours, what part of 144 miles will she sail in 9 hours? how many miles?

9. A man owning 360 acres of land, gave $\frac{3}{8}$ of it to his first son, $\frac{2}{5}$ of $3\frac{1}{2}$ times as much to the second, and the remainder to the third. What part of the whole did each receive? how many acres?

10. A merchant sold a hogsheaf of sugar and gained $\frac{4}{5}$ of \$46 $\frac{3}{4}$, which was $\frac{1}{3}$ of twice the sum it cost him. What was the cost, and what part of the cost was the gain?

11. If 6 cords of wood cost \$15, how much will 4 cords cost?

SOLUTION. — 4 cords = $\frac{2}{3}$, or $\frac{4}{6}$, of 6 cords; $\frac{4}{6}$ of \$15 = \$10.

12. If 9 pounds of sugar cost 75 cents, how much will 12 pounds cost?

13. If 6 men can cut 45 cords of wood in 3 days, how many cords can 8 men cut in the same time?

14. If $3\frac{1}{2}$ yards of cloth cost \$10 $\frac{1}{2}$, how much will 7 yards cost?

15. If $4\frac{1}{2}$ pounds of cheese cost 66 cents, how much will $2\frac{2}{3}$ pounds cost?

16. If a mechanic earns \$13 $\frac{1}{2}$ in 1 $\frac{1}{2}$ weeks, how much can he earn in 2 $\frac{1}{8}$ weeks?

17. If \$5 $\frac{1}{4}$ will buy 3 $\frac{1}{4}$ cords of wood, how many cords can be bought for \$10 $\frac{1}{2}$?

18. If $\frac{1}{2}$ of a barrel of flour costs \$4 $\frac{1}{2}$, how much will $\frac{2}{3}$ of a barrel cost?

SOLUTION. — What part of $\frac{1}{2}$ is $\frac{2}{3}$? $\frac{2}{3} = \frac{4}{6}$ and $\frac{1}{2} = \frac{3}{6}$; the ratio of $\frac{4}{6}$ to $\frac{3}{6}$ is the same as the ratio of 4 to 3 = $\frac{4}{3}$; $\frac{4}{3}$ of \$4 $\frac{1}{2}$ = \$6.

19. If a man can run 6 miles in $\frac{2}{3}$ of an hour, how far can he run in 3 $\frac{1}{4}$ hours?

20. How many yards of carpeting, $\frac{2}{3}$ of a yard wide, are equal to 12 yards, $\frac{3}{4}$ of a yard wide?

21. If a staff 3 feet long casts a shadow 5 feet in length, what would be the length of the shadow cast by a pole 13 feet long?

22. If it takes 6 $\frac{1}{2}$ hours to saw $\frac{3}{4}$ of a cord of wood, how long will it take to saw 3 $\frac{3}{4}$ cords at the same rate?

23. John earns 9 cents as often as James earns 15 cents. When John has earned 63 cents, how much has James earned?

24. Two persons start from different points and travel towards each other; the first one travels 7 miles while the other travels 5 miles, and when they meet the first one has traveled 70 miles. How far apart were they when they started?

25. If 4 men can build a wall 60 feet long in 6 days, in what time can 3 men build a wall 90 feet in length?

SOLUTION. — In $\frac{2}{3}$ of $\frac{3}{4}$ of 6 days, which is 12 days.

26. If 5 men can do a piece of work in 10 days, how many men will do a piece of work 4 times as large in 20 days?

27. If a peddler traverses a certain beat in 8 days by traveling 9 hours a day, how many days would he require to perform the same journey, if he traveled 12 hours a day ?

28. If 5 horses eat $1\frac{1}{2}$ tons of hay in 1 month, how many tons will 6 horses eat in $2\frac{2}{3}$ months ?

29. If 3 boys earn \$ $\frac{7}{8}$ in $\frac{1}{4}$ of a day, how many days will it take 5 boys to earn \$ $10\frac{1}{2}$ at the same rate ?

30. If a gallon of oil will supply 4 lamps for 5 days, how many gallons would supply 3 such lamps for $2\frac{1}{2}$ days ?

31. If 3 furnaces consume $12\frac{1}{4}$ tons of coal in 7 days, how long will $17\frac{1}{2}$ tons last 5 furnaces ?

32. If 9 men can mow 36 acres of grass in 9 days, how many men will be required to mow 48 acres in 12 days ?

33. If by traveling 6 hours a day at the rate of 4 miles an hour, a man traverses a certain distance in 3 days, in how many days, traveling 9 hours a day, at the rate of 3 miles an hour, can he go the same distance ?

34. If 2 yards of cloth, 1 yard wide, cost \$ 3.00, how much will 36 yards of the same cloth, 2 yards wide, cost ?

35. If 4 horses consume 32 bushels of oats in 50 days, how many bushels will 5 horses consume in 80 days ?

36. If 6 laborers dig a ditch 34 yards long in 10 days, how many yards can 20 laborers dig in 15 days ?

37. If 3 men can build 30 rods of fence in 2 weeks, how long will it take 2 men to build 20 rods of the same kind of fence ?

38. Nelly can shell 2 pecks of peas in $1\frac{1}{2}$ hours. How many can her little sister, who works half as fast, shell in 2 hours ?

39. If it takes 3000 bricks to build a certain length of wall 6 feet high, and 2 feet thick, how many bricks will it take to build the same length of wall 8 feet high and 1 foot thick ?

PERCENTAGE.

111. Per Cent means *by the hundredths*, and indicates a certain number of hundredths of anything.

Thus, 5 per cent of \$ 500 = .05 or $\frac{5}{100}$ of \$ 500.

112. The Sign of Per Cent is %.

Thus, 5 per cent is written 5 %.

113. Percentage is the result obtained by taking any per cent of a number.

Thus, 5 % of 100 = 5 ; 5 is the percentage.

114. Change to per cent:

1. .08	4. .325	7. .11	10. $\frac{1}{8}$	13. $\frac{3}{4}$	16. $\frac{5}{8}$
2. $.12\frac{1}{2}$	5. .14	8. .12	11. $\frac{1}{4}$	14. $\frac{3}{7}$	17. $\frac{2}{3}$
3. .06	6. .13	9. $\frac{1}{8}$	12. $\frac{1}{8}$	15. $\frac{5}{7}$	18. $\frac{5}{8}$

NOTE. — Review carefully the equivalents on page 144, Ex. 152.

Change to common fractions:

19. $8\frac{1}{8}\%$	21. $33\frac{1}{8}\%$	23. $37\frac{1}{2}\%$	25. $87\frac{1}{2}\%$
20. $66\frac{2}{3}\%$	22. $12\frac{1}{2}\%$	24. $88\frac{8}{9}\%$	26. $57\frac{1}{4}\%$

27. Change $533\frac{1}{3}\%$ to a mixed number.

SOLUTION. — 100 % = 1 unit ; 500 % = 5 units ; $33\frac{1}{3}\% = \frac{1}{3}$;
 $5 + \frac{1}{3} = 5\frac{1}{3}$. Therefore, $533\frac{1}{3}\% = 5\frac{1}{3}$.

Change to mixed numbers :

28. $188\frac{8}{9}\%$	30. 550 %	32. $722\frac{2}{3}\%$	34. $555\frac{5}{9}\%$
29. $387\frac{1}{2}\%$	31. $612\frac{1}{2}\%$	33. $842\frac{4}{7}\%$	35. 375 %

Find:

36. 5% of 20 40. 3% of 50 44. 9% of 81
 37. 7% of 35 41. 7% of 42 45. 12% of 48
 38. 8% of 48 42. 10% of 160 46. 12% of 112
 39. 6% of 18 43. 25% of 96 47. 10% of 100

48. How much is $233\frac{1}{3}\%$ of 24?

SOLUTION. — $233\frac{1}{3}\% = 2\frac{1}{3}$ or $\frac{7}{3}$; $\frac{7}{3}$ of $24 = 56$.

Find:

49. $87\frac{1}{2}\%$ of 96 54. $112\frac{1}{2}\%$ of 80
 50. $66\frac{2}{3}\%$ of 66 55. 75% of 400
 51. $42\frac{3}{4}\%$ of 49 56. $312\frac{1}{2}\%$ of 88
 52. $266\frac{2}{3}\%$ of 600 57. $211\frac{1}{3}\%$ of 99
 53. 375% of 224 58. $262\frac{1}{2}\%$ of 64

59. What is $\frac{2}{3}\%$ of 30?

SOLUTION. — $\frac{2}{3}\% = \frac{2}{300}$; $\frac{\frac{2}{300}}{\frac{10}{5}}$ of 30 = $\frac{1}{5}$.

Find:

60. $\frac{3}{4}\%$ of 28; of 44; of 56; of 84; of 92.
 61. $\frac{1}{3}\%$ of 63; of 120; of 240; of 30; of 60.
 62. $\frac{2}{5}\%$ of 30; of 60; of 120; of 180.
 63. $3\frac{1}{2}\%$ of 70; of 30; of 100.

64. What % of 21 is 7?

SOLUTION. — 7 is $\frac{7}{21}$ or $\frac{1}{3}$ of 21; $\frac{1}{3} = 33\frac{1}{3}\%$.

65. What % of 50 is 5? 10? 20? 25?

66. What % of 40 is 5? 8? 25? 30?

67. What % of 18 is 3? 6? 9? 12?

68. What % of 42 is 6? 7? 2? 3?

69. What % of 30 is 12? 10? 15? 5?

70. What % of 18 is 9? 12? 15? 6?

71. $1\frac{1}{2}$ is what % of 9?

SOLUTION. $1\frac{1}{2} = \frac{3}{2}$; $\frac{3}{2} \div 9 = \frac{1}{6} = \frac{1}{6}$; $\frac{1}{6} = 16\frac{2}{3}\%$.

72. $1\frac{1}{2}$ is what % of 8?

SOLUTION. — $1\frac{1}{2} = \frac{3}{2}$; $\frac{3}{2} \div 8 = \frac{3}{16}$; reducing $\frac{3}{16}$ to 100ths (see p. 44, Ex. 139) the result is .1875, which equals $18\frac{3}{4}\%$.

73. $3\frac{1}{8}$ is what % of 100? 80? 70? 50?

74. $1\frac{1}{2}$ is what % of 30? 60? 10? 90?

75. $2\frac{1}{2}$ is what % of $12\frac{1}{2}$?

SOLUTION. — $2\frac{1}{2} = \frac{5}{2}$; $12\frac{1}{2} = \frac{25}{2}$; $\frac{5}{2}$ bears the same relation to $\frac{25}{2}$ as 5 does to 25; $5 : 25 = \frac{1}{5} = .20 = 20\%$.

76. $\frac{1}{8}$ is what % of $3\frac{1}{8}$? $16\frac{2}{8}$? $8\frac{1}{8}$?

77. $\frac{1}{5}$ is what % of 8? 12? 20?

78. 10 is 5% of what number?

SOLUTION. — If 10 is 5% of a number, 1% is $\frac{1}{5}$ of 10 or 2; and 100%, or the number, is 100×2 , which is 200.

79. 14 is 7% of what number?

80. 15 is 5% of what number?

81. $\frac{3}{4}$ is 1% of what number?

82. $1\frac{1}{5}$ is 6% of what number?

83. 24 is 8% of what number?

84. 33 is $33\frac{1}{3}\%$ of what number?

85. 49 is $14\frac{2}{7}\%$ of what number?

86. 54 is $16\frac{2}{3}\%$ of what number?

87. 45 is 15% of what number?

88. $7\frac{1}{4}$ is $12\frac{1}{2}\%$ of what number?

PROBLEMS.

115. 1. A man bought 75 barrels of apples, and on opening them, found that 8% of them were spoiled. How many barrels were spoiled?

2. If I have \$200 deposited in the bank, and draw out 15% of it, how much remains?

3. A farmer, having 176 sheep, sold 75% of them, and kept the remainder. How many did he keep?

4. A man bought a lot of 104 books, and found that $12\frac{1}{2}\%$ of them were damaged by water. How many books were damaged, and what % of the whole number was in good condition?

5. If you have \$120, and lose $33\frac{1}{3}\%$ of it, how much do you lose?

6. James had 250 marbles, but lost 40% of them. What part of the whole had he left, and how many did he lose?

7. What % of a barrel of flour is $\frac{2}{3}$ of it?

SOLUTION.—Since the whole of any number or thing is equal to 100%, $\frac{2}{3}$ of one barrel of flour is equal to $\frac{2}{3}$ of 100%, or 40%.

8. If a man saves $\frac{5}{8}\%$ of his income, what % does he spend?

9. A merchant invested $\frac{3}{4}$ of his money in dry goods. What % did he invest?

10. A farmer, having 20 sheep, lost 5 of them by disease. What % did he lose?

SOLUTION.—He lost $\frac{5}{20}$ or $\frac{1}{4}$ of them; $\frac{1}{4} = 25\%$.

11. If from a cask containing 63 gallons of molasses, a grocer draws 42 gallons, what % of the whole will remain?

12. From a box of tea containing 60 pounds, 15 pounds were sold at one time, and 25 pounds at another. What % of the whole remained unsold?

13. In a heap of potatoes containing 150 bushels, 3 bushels out of every 5 are bad. What % is bad, and how many bushels are good?

14. A boy reads 80 pages of a book containing 250 pages. What % of the whole has he read, and what % has he still to read?

15. James had $62\frac{1}{2}$ cents, and spent $37\frac{1}{2}$ cents for a book. What % of his money had he left?

16. From a barrel of sugar containing 200 pounds, $\frac{1}{4}$ was sold at one time, and $\frac{1}{8}$ of the remainder at another time. What % remained unsold?

17. A man collects \$240, and receives 5% commission on what he collects. What compensation does he receive?

SOLUTION.—The commission is 5% of the sum collected; $5\% = \frac{5}{100} = \frac{1}{20}$; $\frac{1}{20}$ of \$240 = \$12.

18. At the rate of 10%, what commission does an agent receive for collecting a note of \$800?

19. What must be paid for collecting a tax of \$300, allowing $12\frac{1}{2}\%$ commission?

20. An agent sells \$1200 worth of merchandise, at 25% commission. How much will he receive for his services?

21. An auctioneer sold goods to the amount of \$500. What did his commission amount to at $2\frac{1}{2}\%$?

22. An attorney was paid $3\frac{1}{8}\%$ to collect a debt of \$640. How much did he receive for his services?

23. If a man fails in business, and can pay but 40% of his debts, how much will a creditor receive on a debt of \$175?

24. I bought \$1000 worth of books, receiving a commission of $3\frac{3}{8}\%$. How much did I receive for my services?

25. If a broker sells \$ 600 worth of New York Central Railroad stock, and charges $\frac{3}{4}\%$ commission for selling, how much will he receive ?

26. A real estate agent sold a house and lot for \$ 2000, and charged $1\frac{1}{2}\%$ commission for selling. How much did he receive ?

27. A broker in Chicago exchanged \$ 1200 on a New York bank, at $\frac{3}{8}\%$. What amount of brokerage did he receive ?

28. At $\frac{4}{5}\%$, what will be the expense of negotiating a bill of exchange of \$ 625 ?

29. A merchant sends his agent \$ 780 to expend for merchandise, after deducting his commission of 4%. What sum will he expend ?

SOLUTION. — The money to be expended is $\frac{100}{104}$ of itself, and the commission $\frac{4}{104}$, or $\frac{1}{26}$ of this sum ; hence the whole amount sent to the agent is $\frac{100}{104}$, or $\frac{25}{26}$, of the amount to be expended for merchandise. Since \$ 780 is $\frac{25}{26}$, $\frac{1}{26}$ is $\frac{1}{26}$ of \$ 780, or \$ 30, his commission ; and $\frac{25}{26}$ is $25 \times \$ 30$, or \$ 750, the sum to be expended.

30. I gave a broker \$ 810 to invest in bank stock, after deducting his commission of $1\frac{1}{4}\%$. What was his commission, and how much did he invest ?

31. A miller sent Mr. B. \$ 1550, with which to buy corn, after deducting his commission of $3\frac{1}{5}\%$. How much did he spend for corn and how much did his commission amount to ?

32. How many bushels of wheat, at \$ 1 a bushel, can an agent buy for \$ 1230, and retain $2\frac{1}{2}\%$ commission for his trouble ?

33. A farmer employed a man to thrash his wheat, agreeing to give him 12% of all he thrashed. How many bushels must he thrash in order that the farmer may retain 66 bushels ?

SOLUTION. — Since the thrasher is to receive $\frac{12}{100}$, or $\frac{3}{25}$, of all he thrashes, the farmer will receive the difference between $\frac{22}{25}$ and $\frac{3}{25}$.

which is $\frac{2}{3}$. Then 66 bushels must be $\frac{2}{3}$ of the whole number of bushels to be thrashed; since 66 bushels is $\frac{2}{3}$, $\frac{1}{3} = \frac{1}{2}$ of 66, or 3 bushels, and $\frac{2}{3} = 25 \times 3$ bushels, or 75 bushels.

34. What amount must be collected on a bill, so that the collector may retain his fee of 5% and pay over \$285?

35. What amount of accounts must an individual collect in order to pay over \$1100, and retain $8\frac{1}{2}\%$ for collecting?

36. What must be paid for insuring a house and furniture for \$1000, at $1\frac{1}{4}\%$ premium?

NOTE. — The sum paid for insurance is called a **Premium**.

SOLUTION. — Since the premium is $1\frac{1}{4}$ per cent, or $\frac{1}{80}$, or $\frac{1}{80}$ of the amount insured, the premium on \$1000 will be $\frac{1}{80}$ of \$1000, or \$12 $\frac{1}{2}$.

37. What will be the premium for insuring a quantity of flour, valued at \$1200, at 4%?

38. What must I pay annually for life insurance of \$900, at $2\frac{1}{2}\%$?

39. What must be paid for insuring a case of cloths, valued at \$600, at $1\frac{2}{3}\%$ premium?

40. What is the annual premium of insurance, at $\frac{3}{4}\%$, on a building valued at \$4000?

41. If a merchant has his stock of goods insured for \$2500, at $\frac{4}{5}\%$, what is the premium?

42. A man, owning $\frac{3}{4}$ of a boat load of grain valued at \$1600, insures his interest at $1\frac{3}{8}\%$. What premium does he pay?

43. At 2%, what amount of insurance can I obtain for \$18 premium?

SOLUTION. — Since 2% premium is $\frac{2}{100}$, or $\frac{1}{50}$, of the amount insured, \$18, the given premium, will be equal to $\frac{1}{50}$ of the required amount of insurance. \$18 is $\frac{1}{50}$ of $50 \times \$18$, or \$900.

44. At 3%, what amount of insurance can be obtained on a house, for \$75 premium?

45. At $\frac{3}{4}\%$, what amount of insurance can be obtained on a boat load of flour, for \$24 premium?

46. What amount of insurance can be had for \$45, upon a car load of horses, if the rate of insurance is $4\frac{1}{2}\%$?

47. If the rate is $1\frac{3}{4}\%$, and the premium paid is \$91, what will be the amount of insurance obtained on a store and its contents?

48. If a man buys a horse for \$90, for how much must he sell it to gain 20%?

SOLUTION. — Since he is to gain 20% or $\frac{1}{5}$ of what the horse cost him, he must sell it for $\frac{6}{5}$ of what it cost; $\frac{6}{5}$ of \$90 = \$108.

49. A sleigh was bought for \$50, and sold for 8% more than it cost. For how much was it sold?

50. A rare vase, worth \$84, increased in value $12\frac{1}{2}\%$. What was it then worth?

51. A grocer bought some tea for \$45, but finding it damaged, he was obliged to sell it at a loss of 10%. For how much did he sell it?

52. By embroidering a piece of linen that cost me \$12, I increased its value 75%. How much was it then worth?

53. A drover bought 60 sheep for \$180, and sold them at a loss of 20% on the cost. How much apiece did he receive for them?

54. A grocer bought 440 lemons for \$12, and after throwing away 10% of them, lacking 4, as worthless, he sold the remainder so as to gain $33\frac{1}{3}\%$ on the cost of the whole. For how much apiece did he sell them?

55. I bought 6 young rabbits for \$4.00. For how much apiece must I sell them in order to gain 5% on the cost?

56. If I buy eggs at 30 cents a dozen, for what price must I sell them to gain 30%?

57. A speculator bought a quantity of pork for \$ 500, and sold it at a loss of 7%. With the proceeds he bought another quantity, upon which he gained 20%. How much did he gain on the whole?

58. A farmer gathered in 14 bushels of oats, which was $12\frac{1}{2}\%$ less than his neighbor's crop. What was his neighbor's crop?

59. What % is gained by selling clover seed that cost \$ 4 for \$ 6?

SOLUTION. — The gain is \$ 2. \$ 2 is $\frac{1}{2}$ of \$ 4; $\frac{1}{2} = 50\%$.

60. What % is gained by selling pork that cost \$ 6 for \$ 7?

61. How much will be gained by investing \$ 500 in sugar, which can be bought for 8 cents, and sold for $8\frac{1}{2}$ cents a pound?

62. If I buy \$ 300 worth of sheep, and sell them for \$ 375, what % do I gain?

63. Mr. C. bought a horse for \$ 150, and sold it for \$ 125. What % did he lose?

64. A grocer bought melons for 9 cents apiece, and sold them for 12 cents apiece. What % did he gain?

65. What % is lost in buying corn at 50 cents a bushel, and selling it at 45 cents?

66. If a house brings $\frac{1}{4}$ of its value every 4 years in rent, what is the gain % each year?

67. I spent 20% less than \$ 150 on my market garden, and sold the produce from it for 10% more than \$ 150. What % did I gain?

68. A fruit vender bought oranges for 18 cents a dozen, and sold them for 2 cents apiece. What % did he gain?

69. A farmer refused to sell his barley for 75 cents a bushel, and was afterwards obliged to take 60 cents a bushel for it. What % did he lose?

70. For every $7\frac{1}{2}$ bushels of oats that a farmer raised one year, he raised 9 bushels the next. What % of increase was the second year's crop over the first?

71. I was obliged to sell damaged goods at a loss equal to $\frac{1}{8}$ of their cost? What % was lost?

72. A hatter sold a hat for $\$3\frac{1}{2}$, which was $16\frac{2}{3}\%$ above cost. What was the cost?

73. A tailor sold a coat for \$24, by which he gained 20% on the cost. What was the cost?

SOLUTION.—Since he gained 20%, or $\frac{1}{5}$ of the cost, \$24 is $\frac{4}{5}$ of the cost; since \$24 is $\frac{4}{5}$, $\frac{1}{5}$ of \$24, or \$4, is $\frac{1}{5}$ of the cost, and $5 \times \$4 = \20 , the cost.

74. A merchant sold 2 barrels of sugar for \$24 each; on one barrel he gained 20%, and on the other he lost 20%. Did he gain or lose by the transaction, and how much?

SOLUTION.—The cost of the first barrel is found, as in Ex. 73, to be \$20; $\$24 - \$20 = \$4$, the gain.

Since 20% or $\frac{1}{5}$ was lost by selling the second barrel at \$24, $\$24 = \frac{4}{5}$ of cost; $\frac{1}{5}$ of $\$24 \times 5 = \30 , the cost; $\$30 - \$24 = \$6$, the loss. $\$6 - \$4 = \$2$, the total loss.

75. A certain field yielded 65 bushels of potatoes, which was 30% increase on the previous year's crop. What was the previous year's crop?

76. A man sold a carriage for \$108, which was 10% less than it cost. How much would he have received for it had he sold it so as to gain 20%?

77. There are 50 pupils in one class, which is $16\frac{2}{3}\%$ less than the number in another class. How many pupils are there in the second class?

78. In an orchard there were 400 pear trees which was $33\frac{1}{3}\%$ less than the number of apple trees. How many apple trees were there?

79. A man bought a horse and carriage; he sold them both at 8% above cost, receiving \$81 for the horse, and \$108 for the carriage. What was the cost of both?

80. In a basket of pineapples 96 were good, and 4% were bad. How many pineapples were there altogether in the basket?

81. B sold a horse to C, and gained $12\frac{1}{2}\%$; C sold it to D for \$118, and thereby gained 18%. How much did the horse cost B?

82. I sold wheat so as to gain 16 cents on a bushel, which was $12\frac{1}{2}\%$ of what it cost. What was the cost?

83. A rosebush had 200 roses; 50 of them were plucked and 25 were blown off by the wind. What % of the whole remained on the bush?

84. A broker exchanged \$150 at $\frac{1}{3}\%$. How much brokerage did he receive?

85. What % would be gained by selling apples at $\frac{7}{8}$ of their cost?

86. If I buy stoves at \$12 each, and sell them at $8\frac{1}{2}\%$ profit, how much shall I gain on 1 stove?

87. If a broker buys \$800 worth of bank stock for me, and charges $\frac{1}{4}\%$ brokerage, how much will he receive?

88. A dairyman churned 250 pounds of butter which was 40% of the quantity he had promised to deliver. How much more must he churn?

89. Mr. A. lends his money so as to receive a sum equal to $\frac{1}{10}$ of it for its use. What % does he receive?

90. A man agreed to dig a farmer's potatoes for 8% of what he should put into the farmer's cellar; he dug 324 bushels. How many bushels should be put into the cellar, and how many bushels should the man receive?

91. A merchant sends a buyer \$ 520 with which to purchase goods, after deducting his commission of 4%. How much does the agent spend, and how much does his commission amount to ?

SUGGESTION.—\$ 520 includes the amount spent and the 4% commission. Therefore \$ 520 is 104% of the amount spent.

92. A man bought \$ 200 worth of dry goods, and \$ 300 worth of groceries. He sold the dry goods at a loss of 20%, but gained 15% in selling the groceries. Did he gain or lose on the whole capital, and how much ?

93. A merchant bought 40 bushels of grass seed, at the rate of 4 bushels for \$ 6, and sold it at the rate of 5 bushels for \$ 8. What was his whole gain, and what was his gain per cent ?

94. A drover bought 20 sheep for \$ 50, and sold them so as to gain 20%. How much did he receive a head for them ?

95. A man bought 60 cords of wood for \$ 200, and sold the wood at a loss of 5%. At what price did he sell it per cord ?

96. If one pupil writes 5 lines for every 4 that his companion writes, what per cent faster does the first write than the second ?

97. A desk that cost \$ 20 was sold at auction for \$ 18. What was the loss per cent ?

98. A boy bought peaches at the rate of 3 for 2 cents, and sold them at the rate of 9 for 7 cents. What was his gain per cent ?

99. A tailor sold two coats for \$ 26 each. On one he gained 30%, and on the other he lost 30%. Did he gain or lose on both, and how much ?

100. Two men buy a lot of pork together. A furnishes \$ 200, and B \$ 150. Their joint profits are \$ 70. What is their gain per cent, and what is each one's share of the gain ?

INTEREST.

116. Interest is a sum paid for the use of money.

117. The **Principal** is the money for the use of which the interest is paid.

118. The **Amount** is the sum of the principal and interest.

119. The **Rate Per Cent** per annum is the per cent paid for the use of the money annually.

Thus the interest of any sum for one year at 5% is $\frac{1}{20}$ or $\frac{1}{20}$ of the principal, and 5% is the rate.

120. Practically 30 days are considered a month, and 12 months a year, in computing interest.

121. 1. What is the yearly interest of \$ 80, at 5% ?

SOLUTION. — 5% of \$ 80 = \$ 4.

Find the yearly interest of:

2. \$ 200 at 6%

8. \$ 96.32 at $6\frac{1}{2}$ %

3. \$ 125 at 4%

9. \$ 144.60 at $8\frac{1}{2}$ %

4. \$ 60 at 7%

10. \$ 400 at 15%

5. \$ 95 at 5%

11. \$ 500 at 7%

6. \$ 26 at 10%

12. \$ 120.80 at 7%

7. \$ 224 at $12\frac{1}{2}$ %

13. \$ 1000 at $9\frac{1}{2}$ %

14. What is the interest of \$ 150 for 3 years at 8% ?

SOLUTION. — The interest of \$ 150 for 1 year at 8% is $\frac{8}{100}$ of \$ 150, or \$ 12; the interest for 3 years is $3 \times \$ 12$, or \$ 36.

Find the interest of :

15. \$ 30 for 2 years at 5%

16. \$ 50 for 4 years at 6%

17. \$ 90 for 5 years at 7%

18. \$ 75 for 3 years at 12%

19. \$ 225 for 2 years at 7%

20. \$ 50 for 8 years at 6%

21. \$ 400 for 2 years at $5\frac{1}{2}\%$

22. \$ 600 for 5 years at 6%

23. What is the amount of \$ 30 for 2 years at 5% ?

SOLUTION. — The interest of \$ 30 for 2 years at 5% is \$ 3; the amount is \$ 30 + \$ 3 = \$ 33.

Find the amount of each of the following sums for 3 years, at 6% :

24. \$ 5 27. \$ 33 30. \$ 67 33. \$ 44

25. \$ 8 28. \$ 72 31. \$ 52 34. \$ 100

26. \$ 10 29. \$ 38 32. \$ 89 35. \$ 500

Find the amount of :

36. \$ 12 for 2 yr. at 4% 39. \$ 25 for 1 yr. at 4%

37. \$ 16 for 3 yr. at 8% 40. \$ 78 for 5 yr. at 12%

38. \$ 18 for 9 yr. at 7% 41. \$ 120 for 6 yr. at 8%

42. What is the interest of \$ 40 for 3 yr. 4 mo. at 6% ?

SOLUTION. — 3 yr. 4 mo. = $3\frac{4}{12}$ yr., or $\frac{10}{3}$ of a year; the interest of \$ 40 for 1 yr., at 6%, is \$ 2.40; the interest for $\frac{10}{3}$ of a year is $\frac{10}{3}$ of \$ 2.40, which is \$ 8.

Find the interest and amount of :

43. \$ 150 for 2 yr. 10 mo. at 8%
44. \$ 80 for 4 yr. 2 mo. at 6%
45. \$ 240 for 1 yr. 9 mo. at 5%
46. \$ 500 for 10 mo. at 6%
47. \$ 120 for 5 yr. 8 mo. at $7\frac{1}{2}\%$
48. \$ 50 for 7 mo. at 8%
49. \$ 90 for 4 yr. 7 mo. at 4%
50. \$ 128 for 9 mo. at 5%

51. What is the interest of \$ 50 for 5 yr. 7 mo. and 15 da. at 8% ?

SOLUTION. — 7 mo. = $\frac{7}{12}$ yr. ; 15 da. = $\frac{15}{360}$, or $\frac{1}{24}$ of a yr. ; $5 + \frac{7}{12} + \frac{1}{24} = 5\frac{1}{4} = 5\frac{1}{4}$. Since the interest of \$ 50 for 1 year at 8% is \$ 4, for $\frac{1}{4}$ of a year it is $\frac{1}{4} \times \$ 4$, which is $\frac{1}{4} \times \$ 4$ or \$ 22 $\frac{1}{2}$.

Or, the interest of \$ 1 for $\frac{1}{4}$ yr. at 8% is $\frac{1}{4} \times $.08 = $.45, and the interest of $ 50 is $50 \times $.45 = $ 22.50.$$

Find the interest and amount of :

52. \$ 70 for 4 yr. 5 mo. 10 da. at 9%
53. \$ 50 for 6 yr. 4 mo. 24 da. at 5%
54. \$ 300 for 4 yr. 7 mo. 15 da. at 8%
55. \$ 288 for 8 mo. 10 da. at $7\frac{1}{2}\%$
56. \$ 1200 for 20 da. at 6%
57. \$ 40 for 9 mo. 5 da. at $4\frac{1}{2}\%$
58. \$ 36.72 for 5 yr. 6 mo. 20 da. at 7%
59. \$ 120 for 2 yr. 1 mo. 6 da. at $12\frac{1}{2}\%$
60. \$ 24 for 11 mo. 15 da. at 10%
61. \$ 2000 for 18 da. at 5%
62. \$ 1500 for 2 mo. 24 da. at 6%

63. What principal will gain \$ 30 in 5 yr. at 6% ?

SOLUTION. — \$ 1 will gain \$.30 in 5 yr. at 6% ; it will take as much principal to gain \$ 30 as \$.30 is contained times in \$ 30, which is 100 times. Therefore it will take a principal of \$ 100 to gain \$ 30 in 5 yr. at 6%.

Find the principal that will gain :

64. \$ 36 in 3 yr. at 6% 67. \$ 100 in 10 yr. at 6%

65. \$ 56 in 2 yr. at 4% 68. \$ 24 in 4 yr. at 6%

66. \$ 20 in 5 yr. at 5% 69. \$ 30 in 2 mo. at 6%

70. \$ 30 in 1 yr. 8 mo. at 9%

71. \$ 21 in 1 yr. 2 mo. at 6%

72. \$ 13 in 6 mo. 15 da. at 12%

73. \$ 14.20 in 2 yr. 4 mo. 12 da. at 6%

74. \$ 76.80 in 4 yr. 3 mo. 6 da. at 9%

75. \$ 17.04 in 3 yr. 6 mo. 18 da. at 8%

76. What principal will amount to \$ 720 in 3 yr. 4 mo. at 6% ?

SOLUTION. — The interest of \$ 1 for 3 yr. 4 mo. at 6% is \$.20, and the amount is \$ 1.20 ; it will take as many times \$ 1 to amount to \$ 720 as \$ 1.20 is contained times in \$ 720, which is 600 times. Therefore it will take \$ 600 principal.

Find the principal that will amount to :

77. \$ 1300 in 5 yr. at 6%

78. \$ 280 in 1 yr. 6 mo. at 8%

79. \$ 339 in 4 yr. 4 mo. at 3%

80. \$ 340 in 10 yr. at 7%

81. \$ 107.50 in 9 mo. at 10%

82. \$ 530 in 18 mo. at 4%

83. \$ 516 in 8 yr. at 9%

84. \$ 412 in 6 mo. at 6%

85. In what time will \$ 60 gain \$ 15 at 5% ?

SOLUTION. — \$ 60 will gain \$ 3 in 1 year at 5% ; it will take as many years to gain \$ 15 as \$ 3 is contained times in \$ 15, which is 5 times. Therefore it will take 5 years.

In what time will

86. \$ 120 gain \$ 14.40 at 6% ?

87. \$ 500 gain \$ 35 at 7% ?

88. \$ 80 gain \$ 9.60 at 3% ?

89. \$ 300 gain \$ 84 at 7% ?

90. \$ 120 gain \$ 40 at 10% ?

91. \$ 160 gain \$ 20 at $6\frac{1}{4}\%$?

92. \$ 49 gain \$ 12.25 at 5% ?

93. \$ 300 gain \$ 42 at 7% ?

94. In what time will \$ 30 amount to \$ 40 at 10% ?

SOLUTION. — When \$ 30 amounts to \$ 40 the gain is \$ 10. Since \$ 30 will gain \$ 3 in 1 yr. at 10%, it will take as long to gain \$ 10 as \$ 3 is contained times in \$ 10, which is $3\frac{1}{3}$ times. Therefore it will take $3\frac{1}{3}$ yr., or 3 yr. 4 mo.

In what time will

95. \$ 60 amount to \$ 75 at 5% ?

96. \$ 50 amount to \$ 62 at 6% ?

97. \$ 40 amount to \$ 50 at 10% ?

98. \$ 120 amount to \$ 144 at 6% ?

99. \$ 160 amount to \$ 180 at $6\frac{1}{4}\%$?

100. \$ 300 amount to \$ 342 at 7% ?

101. In what time will \$ 5 double itself at 4% ?

SOLUTION. — This means “in what time will \$ 5 gain \$ 5 at 4%.” In 1 yr., at 4%, \$ 5 gains \$.20 ; it will take as many years to gain \$ 5 as \$.20 is contained times in \$ 5, which is 25 times. Therefore it will take 25 years to double itself.

102. In what time will any principal double itself at 6% ?

SOLUTION. — Since in 1 yr. at 6% a principal gains 6% and since to double itself it must gain 100%, it will take as many years as 6% is contained times in 100%, or $16\frac{2}{3}$ years.

103. In what time will a given principal treble itself at 6% ?

SUGGESTION. — To treble itself a principal must gain 200%, to quadruple itself 300% etc.

Find the time in which a sum will double itself

- | | | |
|------------|------------|-------------|
| 104. At 7% | 107. At 3% | 110. At 8% |
| 105. At 5% | 108. At 2% | 111. At 9% |
| 106. At 4% | 109. At 6% | 112. At 10% |

Find the time in which a sum will treble itself

- | | | |
|------------|------------|-------------|
| 113. At 3% | 116. At 7% | 119. At 4% |
| 114. At 2% | 117. At 5% | 120. At 10% |
| 115. At 9% | 118. At 6% | 121. At 11% |

Find the time in which a sum will quadruple itself

- | | |
|------------|------------|
| 122. At 6% | 124. At 4% |
| 123. At 5% | 125. At 7% |

126. In what time will \$ 500 double itself at 6% ?

127. In what time will \$ 175 double itself at 20% ?

128. In what time will \$ 65 double itself at 3% ?

129. At what per cent will \$ 500 gain \$ 75 in 5 years ?

SOLUTION. — At 1% \$ 500 in 5 yr. gains \$ 25 ; it will take as many % to gain \$ 75 as \$ 25 is contained times in \$ 75, or 3%.

At what per cent will.

- 130. \$ 12 gain \$ 5 in 10 yr. ?
- 131. \$ 400 gain \$ 50 in $2\frac{1}{2}$ yr. ?
- 132. \$ 150 gain \$ 44 in $3\frac{3}{4}$ yr. ?
- 133. \$ 125 gain \$ 37.50 in 5 yr. ?
- 134. \$ 800 gain \$ 75 in 1 yr. 3 mo. ?
- 135. \$ 180 gain \$ 43.05 in 3 yr. 5 mo. ?
- 136. \$ 1250 gain \$ 312.50 in 2 yr. 6 mo. ?
- 137. \$ 2500 gain \$ 300 in 1 yr. $2\frac{2}{3}$ mo. ?

138. At what per cent will any sum double itself in 5 yr. ?

SOLUTION. — At 1% any sum will gain 5% in 5 yr. Since to double itself it must gain 100%, the rate must be as many times 1% as 5% is contained times in 100%. Therefore it must be 20%.

Find the per cent at which any sum will double itself

- | | |
|----------------|----------------------|
| 139. In 10 yr. | 143. In 12 yr. |
| 140. In 4 yr. | 144. In 100 yr. |
| 141. In 8 yr. | 145. In 12 yr. 6 mo. |
| 142. In 7 yr. | 146. In 2 yr. 3 mo. |
- 147. At what per cent will \$ 200 double itself in 4 yr. ?
 - 148. At what per cent will \$ 100 double itself in 8 yr. ?
 - 149. At what per cent will \$ 150 double itself in 15 yr. ?
 - 150. At what per cent will \$ 500 treble itself in 16 yr. 8 mo. ?
 - 151. At what per cent will \$ 175 quadruple itself in 2 yr. 6 mo. ?

PROBLEMS.

122. 1. A's note of \$25 has been due 2 years. What is the interest, at 6%?

SOLUTION.—The interest for 2 years at 6% is 12% of the principal; 12% of \$25 = \$3.

2. I borrowed \$300 for 3 years, at 7%. What will be the interest?

3. What is the interest on a note of \$46.50, for 5 years, at 10%?

4. I owe two notes, one for \$145, due in 2 years, at 5%, and the other for \$200, due in 3 years, at 6%. How much interest must I pay on both?

5. A man gave a note for \$88.96, due in 4 years, at $6\frac{1}{4}\%$. What will be the interest?

6. I gave a note due at date, for \$45.50, but did not pay it until the end of 5 years. What was the interest due, at 8%?

7. A rents a store to B for a yearly rent of \$360, which is 12% of the cost. What is the cost?

8. What is the interest on a loan of \$1500, made Jan. 1, 1892, and called in Jan. 1, 1895, if the rate is 6%?

9. A man bought 6 horses, for which he paid a sum of money which in 2 years 6 months, at 4%, would have given him \$90 interest. How much did he pay for each horse?

SOLUTION.—The interest of \$1 for 2 years 6 months, at 4%, is \$.10, and it will take as many dollars to gain \$90 as \$.10 is contained times in \$90, which is 900 times. Therefore it will take \$900; $\frac{1}{3}$ of \$900 = \$150, the price of each horse.

10. A man deposits $\frac{2}{3}$ of his money in the bank, which brings him an annual income of \$1500, at 10%; the remaining $\frac{1}{3}$ he invests in business which yields him

20% profit. What are his entire capital and his yearly income?

11. A man bought a house for \$ 5000. He paid \$ 2000 cash, \$ 1500 in 6 mo., at 6% interest, and the remainder in 1 yr., at the same rate. How much did the house cost him altogether, and how much would he have saved by paying cash?

12. Two men engaged in trade; A furnished $\frac{5}{8}$ of the capital, and B $\frac{3}{8}$; at the end of 3 years and 4 months they found that they had made a clear profit of \$ 5000, which was $12\frac{1}{2}\%$ per annum on the money invested. How much capital did each furnish?

13. A capitalist invested $\frac{2}{3}$ of his money in railroad stock, which depreciated 5% in value; the remaining $\frac{1}{3}$ he invested in bank stock, and at the end of 1 year this had gained \$ 1200, which was 12% of the investment. What was the whole amount of his capital, and what was his entire loss or gain?

14. The amount due on a bond and mortgage bearing interest at 6%, at the end of 7 years 6 months, was \$ 2900. What was the principal?

SOLUTION. — The interest of \$ 1 for 7 yr. 6 mo., at 6% = \$.45, and the amount is \$ 1.45; \$ 2900 is the amount of as many dollars as \$ 1.45 is contained times in \$ 2900, which is 2000. Therefore the principal was \$ 2000.

15. After leaving a certain sum of money in a bank that paid 6% interest, for 3 years, I drew out the entire amount, \$ 472. How much had I deposited?

16. Two men bought 200 acres of land, and at the end of 2 years sold it for \$ 1500, which was an advance of $12\frac{1}{2}\%$ per annum on its cost. What was the cost per acre?

17. A man invested $\frac{2}{3}$ of all he was worth in the lumber trade, and at the end of 2 years 8 months sold out his entire interest for \$ 3100, which was a yearly

gain of 9% on the money invested. How much was he worth when he commenced trade?

18. A's money is to B's as 2 to 3; if $\frac{1}{2}$ of A's money is put at interest for 3 years 9 months, at 10%, it will amount to \$550. How much money has each?

19. If I deposit \$750 in a bank which pays interest at 4%, in what time can I draw out \$120 without removing any part of the original sum?

SOLUTION. — In 1 year, at 4%, \$750 will gain 4% of \$750 or \$30, and it will take as many years to gain \$120 as \$30 is contained times in \$120, which is 4 times. Therefore it will take 4 years.

20. On Jan. 1, 1889, I deposited \$500 in a savings bank which pays 5% interest. How long must I leave it there so that when I draw it out it will have amounted to \$700?

21. A man loaned \$75 for 4 years, and received \$18 interest. What was the rate per cent?

SOLUTION. — At 1% in 4 years \$75 gains 4% of \$75 or \$3, and it takes as many per cent to gain \$18 as \$3 is contained times in \$18. Therefore the rate per cent was 6.

22. If A lends \$100 for 3 years and receives \$15 interest, what is the rate per cent?

23. An investment of \$3000 paid me \$900 in 3 years. What rate of interest did it pay?

24. If I lend Mr. Roome \$2500 for 2 years and at the end of the time he pays me \$2750, what is the rate of interest?

25. If I put \$500 in a savings bank for 2 years and draw out \$540 at the end of the time, what rate of interest does the bank pay?

26. If I put \$1200 in a savings bank for 1 year, and draw out \$1248 at the end of the year, what rate of interest does the bank pay?

MISCELLANEOUS PROBLEMS.

123. 1. A man owning $\frac{4}{5}$ of a vessel, sold $\frac{3}{5}$ of his share. What part of the vessel does he still own?

SOLUTION.—Since he sold $\frac{3}{5}$ of his share, he has $\frac{1}{5}$ left; $\frac{1}{5}$ of $\frac{4}{5} = \frac{4}{25}$.

2. A man, owning $\frac{7}{8}$ of a share in a railroad, sold $\frac{3}{8}$ of it. What part of a share had he left?

3. A man who had $\frac{1}{2}$ of a barrel of flour, gave $\frac{1}{4}$ of it to a neighbor. What part of a barrel had he left?

4. Harry had $\frac{3}{4}$ of a dollar and he paid $\frac{3}{8}$ of it for a knife. What part of a dollar had he left?

5. A man sold a watch for \$18, which was $\frac{3}{4}$ of what it cost him. How much did he lose?

6. A grocer sold a quantity of cheese for \$45, which was $\frac{3}{8}$ of what it cost him. How much did he gain?

7. A thrashing machine was sold for \$120, at a sacrifice of $\frac{3}{4}$ of the cost. What was the loss on it?

8. A man loaned another $\frac{3}{4}$ of his money, spent $\frac{1}{4}$ of the remainder, and then had \$22 left. How much money had he at first?

9. A horse was sold for \$80, which was $\frac{1}{2}$ of $\frac{2}{3}$ of twice the cost. How much was lost on the horse?

10. A man bought a wagon for \$54, which was $\frac{3}{4}$ of twice as much as he sold it for. What was his gain?

11. A certain bush bore 15 blossoms, which was $\frac{2}{3}$ of 3 times as many as a neighboring bush bore. How many blossoms were there on the second bush?

12. Thomas paid 4 cents for a top, which was $\frac{3}{4}$ of $\frac{1}{2}$ of all the money he had. How many marbles, at 2 for a cent, could he buy with what he had left?

13. A farmer, after selling $\frac{3}{4}$ of his flock of sheep, had 20 left. How many had he at first?

14. A pole was standing $\frac{2}{3}$ of its length in the air, $\frac{1}{3}$ of the remainder in the water, and 3 feet in the mud. How many feet did it stand in the air?

15. If from my age you take $\frac{1}{2}$ and $\frac{3}{4}$ of my age, the remainder will be 4 years. How old am I?

16. If to $\frac{3}{4}$ of the cost of A's coat you add \$12, the sum will be \$20. What is the cost of the coat?

17. A drover, being asked how many sheep he had, replied, "If to $\frac{1}{2}$ my number you add 80 sheep, the sum will be 5 more than 3 times my number." How many had he?

18. I had some spools of thread in a drawer, and some on a table. I put into the drawer 16 of the spools on the table, which was $\frac{3}{4}$ of twice as many as there were then left on the table. Before I made this change, $\frac{3}{4}$ of the number in the drawer equaled $\frac{3}{4}$ of those on the table. How many were there originally on the table and in the drawer?

19. $\frac{3}{4}$ of Herbert's age, increased by 10 years, equals $1\frac{1}{4}$ times his age. How old is he?

20. A cow cost \$40; $\frac{2}{3}$ of this sum was $\frac{1}{11}$ of $2\frac{2}{3}$ times $\frac{1}{4}$ of the cost of a horse. What was the cost of the horse?

21. A was 25 years of age when he was married, and his age was $\frac{5}{7}$ times $\frac{7}{4}$ of his wife's age. How old was she?

22. At the battle of Long Island the Americans lost 500 men; $\frac{1}{5}$ of this number was $\frac{2}{3}$ of $\frac{3}{10}$ of their force. How many men had they in the field?

23. A's farm cost \$1500; $\frac{2}{3}$ of this was $\frac{1}{2}$ of 4 times the cost of the barn. What was the cost of the barn?

24. In a flock of wild pigeons 100 were shot; $\frac{3}{4}$ of those shot was $7\frac{1}{2}$ times $\frac{1}{100}$ of the whole number in the flock; how many pigeons were there in the flock?

25. The American loss at the battle of Trenton, in killed and frozen, was 4 men; 25 times this number was $\frac{1}{2}$ of $\frac{1}{50}$ of the number engaged. How many men were there in the engagement?

26. In a poultry yard there were 100 chickens; $\frac{4}{5}$ of this number was 10 more than $1\frac{1}{2}$ times $\frac{1}{20}$ of all the fowls in the yard. How many fowls were there in the yard?

27. In a garden there were 30 white roses; $2\frac{1}{2}$ times this number was $3\frac{1}{2}$ times $\frac{1}{10}$ of all the roses in the garden. How many roses were there?

28. At Germantown, the American loss, in slain, wounded, and prisoners, was 1200; $\frac{5}{8}$ of this number was $8\frac{1}{2}$ times $\frac{1}{100}$ of $\frac{1}{2}$ of the army, lacking 1000 men. How many were there in the army?

29. Divide 28 into two numbers that shall be to each other as 5 to 2.

SOLUTION. — Since the numbers are to each other as 5 to 2, the given sum must be divided into 7 equal parts, and 5 of those parts will equal one of the numbers, and 2 of them the other; the numbers will be $\frac{5}{7}$ of 28 and $\frac{2}{7}$ of 28, equal to 20 and 8.

30. Two men bought 40 bushels of potatoes; one paid \$6, and the other \$4. How many bushels should each have?

31. Two travelers, 49 miles apart, approach each other; one travels 4 miles an hour, the other 3 miles an hour. How many miles will each travel before they meet?

32. A and B hired a horse and buggy for \$25; A used it 3 weeks, B 2 weeks. How much should each pay?

33. Two men hired a pasture for \$24; one put in 5 cows, the other, 3 cows. How much should each pay?

34. Two men agreed to do a piece of work together for \$12; one worked 2 days and the other 4 days. How much should each receive?

35. John had 9 cents, and James had 7; they paid them all for 32 figs. How many figs should each of them have?

36. A and B enter into partnership; A invests \$10 for 5 months and B invests \$5 for 8 months; they gain \$45. What is each man's share of the gain?

SOLUTION. — The use of \$10 for 5 mo. = the use of \$50 for 1 mo.; the use of \$5 for 8 mo. = \$40 for 1 mo.; \$50 + \$40 = \$90; the first is entitled to $\frac{50}{90}$ or $\frac{5}{9}$ of \$45, which is \$25; the second to $\frac{40}{90}$ or $\frac{4}{9}$ of \$45, which is \$20.

37. A, B, and C bought a horse; A paid \$5 as often as B \$4 and C \$3; they gained \$24 in selling him. What is each man's share of the gain?

38. Three men agree to mow a field for \$40; A sends 2 men 3 days, B sends 3 men 3 days, C sends 2 men $2\frac{1}{2}$ days. How much should each receive?

39. A, B, and C traded in company; A put in \$30, B \$50, and C such a sum that he took \$10 of the \$42 gained during the year. What was the gain of A and B, and what was C's stock?

40. Two men paid \$11 for the use of a pasture; the first put in 6 calves, the second 4 colts. How much should each pay, if 2 colts consume as much as 3 calves?

41. A, B, and C hire a field for \$42; A puts in 5 cows, B 3 cows, and C pays $\frac{1}{3}$ of the rent. How much must A and B pay, and how many cows does C put in?

42. An ignorant partner, who furnished \$500 of a capital of \$800, on which \$240 had been gained, took

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42. An ignorant partner, who furnished \$500 of a capital of \$800, on which \$240 had been gained, took

\$ 145 for his share of the profits. Did he gain or lose, and how much?

43. Mary and Emma together peeled 60 apples and Mary peeled $\frac{7}{8}$ as many as Emma did. How many apples did each peel?

44. Three men paid \$56 for a pasture; the first put in 9 oxen, the second 8 cows, and the third 10 calves. How much should each pay, if 4 cows eat as much as 3 oxen, and 5 calves as much as 4 cows?

45. A gardener gave 24 pears to some school children, giving each girl 4 pears, and each boy 3; the boys together received as many pears as the girls. How many children were there?

46. A father divided \$96 among his 2 sons and 3 daughters, giving each son $\frac{1}{2}$ as much as each daughter. How much did each receive?

47. There are 76 clothespins in 3 bags; in the second there are 2 more than in the first, and in the third 6 more than in the second. How many are there in each bag?

48. James, Henry, and Joseph, together have 72 apples; Henry has 2 more than James, and Joseph 2 more than Henry. If each had no more than James, how many would all have?

49. If each had as many as Joseph, how many would all have?

50. How many must Joseph give James that each may have the same number?

51. Three boys together collected 600 shells; the second gathered 100 more than the first, and the third as many as the first and second together. How many did each collect?

52. On a Christmas tree there were 42 different colored candles; there were twice as many red candles

as blue ones, and twice as many yellow ones as red ones. How many of each color were there?

53. A span of horses, wagon, and harness cost \$ 225; the difference between the cost of the horses and wagon was $1\frac{1}{2}$ times the cost of the harness, and the cost of the horses was 4 times the cost of the harness. What was the cost of each?

54. B traveled 114 miles in 3 days; the first day he traveled $\frac{1}{2}$ as far as on the last 2 days, and the last day $\frac{1}{2}$ as far as on the first 2 days. How far did he travel each day?

55. A laborer in one week dug 5 rods more than $\frac{1}{2}$ the length of a ditch, and the next week he dug the remaining 20 rods. How long was the ditch?

SOLUTION. — Since he dug 5 rods more than $\frac{1}{2}$ of the ditch the first week, the remainder 20 rods, increased by 5 rods, must equal $\frac{1}{2}$ the ditch; $20 \text{ rods} + 5 \text{ rods} = 25 \text{ rods}$; $2 \times 25 \text{ rods} = 50 \text{ rods}$, the length of the ditch.

56. From a bed of pansies I plucked at one time 2 more than $\frac{1}{3}$ of the whole number; at another time 1 more than $\frac{1}{2}$ of the remainder, and then had 4 left. How many pansies were there at first?

SOLUTION. — Since I plucked at first 2 more than $\frac{1}{3}$, I had 2 less than $\frac{2}{3}$ left; $\frac{1}{2}$ of this is 1 less than $\frac{1}{3}$, but since I plucked 1 more than $\frac{1}{2}$ I plucked exactly $\frac{1}{3}$ the second time. I plucked both times 2 more than $\frac{1}{3}$, and $\frac{1}{3}$, or 2 more than $\frac{2}{3}$, and I therefore had 2 less than $\frac{1}{3}$ left. Thus, 4 is 2 less than $\frac{1}{3}$; hence 6 is $\frac{1}{3}$ the whole number, which is 3×6 , or 18.

57. A farmer, owing a store debt, paid at one time \$ 10 more than $\frac{1}{2}$ of it; at another \$ 20 more than $\frac{1}{2}$ of the remainder, and gave a note of \$ 20 for the balance of the debt. What was the amount of the debt?

58. From a flock of sheep, 20 more than $\frac{1}{2}$ the whole number were sold at one time, and 40 more than $\frac{1}{2}$ the

remainder at another time. There were then 40 sheep left. How many sheep were there at first?

59. A man paid \$5 more than $\frac{3}{4}$ of his grocer's bill; soon after he paid $\frac{2}{3}$ of what remained unpaid, when he found \$3 was still due. What was the amount of his bill?

60. John paid \$10 more than $\frac{1}{2}$ of his year's wages for clothes, and \$12 for a watch; he then lent $\frac{2}{3}$ of what he had left, and having paid \$3 for a pair of boots, had \$5 left. What were his wages?

61. A and B together have \$55; $\frac{1}{2}$ of A's money equals $\frac{2}{3}$ of B's. How many dollars has each?

SOLUTION. — Since $\frac{1}{2}$ of A's money = $\frac{2}{3}$ of B's, A's money = 2 times $\frac{2}{3}$, or $\frac{4}{3}$ of B's; then A has 6, and B 5 equal parts of the money, and both have 11 parts; $\frac{1}{11}$ of \$55 is \$5, or 1 part; $6 \times \$5 = \30 , A's share, and $5 \times \$5 = \25 , B's share.

62. If 34 apples are divided between John and Mary, so that $\frac{2}{3}$ of John's may equal $\frac{3}{4}$ of Mary's, how many will each have?

63. A and B together have 83 sheep; $\frac{2}{3}$ of A's flock, increased by 8 sheep, is equal to B's flock. How many sheep has each?

SOLUTION. — Since B's flock is $\frac{2}{3}$ of A's + 8 and A's flock is $\frac{3}{2}$ of A's, together they are equal to $\frac{5}{2}$ of A's + 8. Thus, 83 sheep = 8 more than $\frac{5}{2}$ of A's; hence 75 sheep = $\frac{5}{2}$ of A's, 15 sheep = $\frac{1}{2}$ of A's, and 45 sheep = A's number; $\frac{2}{3}$ of 45 = 30; 30 + 8 = 38, B's number.

64. One family uses a gallon of milk in three days; another uses a gallon in 4 days. How long will a gallon last both of them?

SOLUTION. — The family that uses a gallon in 3 days uses $\frac{1}{3}$ of a gallon in 1 day, and the family that uses a gallon in 4 days uses $\frac{1}{4}$ of a gallon a day; together they use $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of a gallon a day, and 1 gallon or $1\frac{2}{2}$ will last them as many days as $\frac{7}{12}$ is contained times in $1\frac{2}{2}$, or $1\frac{2}{7}$ days.

65. There are 39 cents in a bank; if 10 cents are taken from $\frac{3}{4}$ of Mary's money, the remainder will be equal to her brother's share of the savings. How many cents has each?

66. Fred has 3 marbles more than John, and $\frac{3}{4}$ of Fred's marbles equals $\frac{1}{2}$ of John's. How many has each?

67. Mary can do the washing in 7 hours; with Jane's assistance she can do it in 4 hours. In what time can Jane do it?

SOLUTION. — Mary can do $\frac{1}{7}$ in 1 hour; Mary and Jane together do $\frac{1}{4}$ in 1 hour; therefore Jane does $\frac{1}{4} - \frac{1}{7} = \frac{3}{28}$ in 1 hour, and it will take her as long to do the whole or $\frac{28}{3}$ as $\frac{28}{3}$ is contained times in $\frac{28}{3}$. Therefore it will take her $9\frac{1}{3}$ hours.

68. Two boys can pitch a quantity of hay in 5 hours; the first can do it in 9 hours. In what time can the second do it?

69. A cistern can be emptied by 2 pipes in $3\frac{5}{8}$ hours, but 1 pipe will empty it in $7\frac{1}{4}$ hours. In how many hours will the other empty it?

70. A can make a vest in $\frac{3}{4}$ of a day, B in $\frac{2}{3}$, and C in $\frac{1}{2}$ of a day. How many more vests can A and B together make in a day than C can?

71. Susan can knit a pair of mittens in $\frac{3}{4}$ of a day, and Sarah can knit a pair in $\frac{2}{3}$ of a day. How many pairs can both knit in a day?

72. What part of a day must Sarah assist Susan that Susan may complete 2 pairs?

SOLUTION. — Susan can knit $\frac{2}{3}$ or $1\frac{2}{3}$ pairs a day, so Sarah must do $\frac{1}{3}$ of a pair. Since Sarah knits a pair in $\frac{2}{3}$ of a day she can knit $\frac{1}{2}$ pair in $\frac{1}{3}$ of a day. Therefore she must assist Susan $\frac{1}{3}$ of a day.

73. What part of a day must Susan assist Sarah that Sarah may complete 3 pairs?

74. John can do some work in $\frac{3}{4}$ of an hour, and James in $\frac{2}{3}$ of an hour. In what time can both together do it?

75. In what time can John do what remains after James has worked $\frac{1}{2}$ an hour?

76. In what time can James do what remains after John has worked $\frac{1}{3}$ of an hour?

77. What part of the work can both do in 1 hour?

78. A and B can clear a field in 15 days; with the help of C they can do it in 9 days. In how many days can C do it alone?

79. A and B together can do a certain piece of work in 6 days; A and C can do it in 8 days; and B and C can do it in 9 days. How long would it take each of them, working alone?

SOLUTION. — A and B can do $\frac{1}{6}$ of the work in 1 day; A and C, $\frac{1}{8}$; and B and C, $\frac{1}{9}$; $\frac{1}{6} + \frac{1}{8} + \frac{1}{9} = \frac{25}{72}$, which represents twice the part they all do in 1 day, since each of the workers is represented twice in the addition; $\frac{1}{2}$ of $\frac{25}{72} = \frac{25}{144}$, the part all do together in 1 day.

If A, B, and C do $\frac{25}{144}$ in a day, and A and B $\frac{1}{6}$ or $\frac{24}{144}$, C must do the difference between $\frac{25}{144}$ and $\frac{24}{144}$, etc.

$$\frac{25}{144} - \frac{24}{144} = \frac{1}{144}, \text{ the part C does in 1 day.}$$

$$\frac{25}{144} - \frac{1}{144} = \frac{24}{144}, \text{ the part B does in 1 day.}$$

$$\frac{25}{144} - \frac{1}{144} = \frac{24}{144}, \text{ the part A does in 1 day.}$$

Hence it will take C $\frac{144}{1} = 144$ days, B $\frac{144}{24} = 6$ days, and A $\frac{144}{24} = 6$ days.

80. In how many days can they do it working together?

81. Patrick, Peter, and Michael can dig 40 rods of a ditch in ten days; Patrick and Peter can do it in 15 days; Peter and Michael can do it in $13\frac{1}{2}$ days. In how many days can Patrick and Michael dig 28 rods?

82. How long will it take each man to dig 30 rods?

83. Three men can do a piece of work in 10 days; the first does $\frac{1}{4}$ as much as the second, the third does $\frac{1}{2}$ as much as the first and second together. In how many days will each do it?

84. James and Frank can cut a field of corn in $6\frac{1}{2}$ days; Frank's day's work exceeds James' by $\frac{1}{4}$ of James'. In how many days can each cut the field?

85. In how many days will the first and second do it?

86. In how many days will the first and third do it?

87. In how many days will the second and third do it?

88. A, B, and C can do a piece of work in 8 days; B and C can do it in 12 days, and A and B in 10 days. In how many days can each, working separately, do it?

89. A cistern can be discharged by 3 pipes in 4 hours; the first and second pipes will discharge it in 8 hours; the first and third in 6 hours. In what time will each pipe discharge it?

90. Three boys can build a fort in 10 hours; the first and the second together can build it in 20 hours, and the second and third in 15 hours. How long will it take the first and third to build it?

91. A barrel of flour would last a brother, sister, and servant 30 days; when the brother was absent it would last sixty days; when the sister was absent it would last 45 days. How long would it last the sister after all had used from it 20 days.

92. A father gave each of his boys 5 cents apiece; had he given them 7 cents apiece, it would have taken 8 cents more. How many boys were there?

SOLUTION. — Since 2 cents was the increase paid to each boy, and 8 cents the increase paid to all, there were as many boys as 2 cents is contained times in 8 cents. Therefore there were 4 boys.

93. Edward gave 6 plums to each of his companions, and had 9 remaining; had he given each of them 8, he would have had but 1 left. How many companions were there?

94. Three times a certain number is 15 less than 6 times the same number. What is the number?

SOLUTION. — Since 3 times a number is 3 times itself less than 6 times the number, 15 is three times the number; $15 \div 3 = 5$.

95. A woman, purchasing calico, found that if she took a quality at 8 cents a yard she would have 11 cents left; but if she took a quality at 12 cents a yard she would need 17 cents more to pay for it. How many yards did she want?

96. Four times a number is 15 less than $6\frac{1}{2}$ times the same number. What is the number?

97. $\frac{5}{8}$ of the number of horses in a stable was 4 more than $\frac{1}{4}$ of them. How many horses were there?

98. The sum of two numbers is 27; their difference is 5. What are the numbers?

SOLUTION. — Since the larger of two numbers always equals the smaller plus the difference, the sum of the two must equal *twice* the smaller plus the difference. Thus, $27 = \text{twice the smaller plus } 5$; hence $22 = \text{twice the smaller number}$; $22 \div 2 = 11$, the smaller number, and $11 + 5 = 16$, the larger number.

99. James and John together have 19 peaches; John has 3 more than James. How many has each?

100. Henry has 9 marbles more than Herbert, and together they have 31. How many has each?

101. Mary has twice as many berries as Martha, and together they have 12 quarts. How many quarts has each?

SOLUTION. — 2 times Martha's + once Martha's = 3 times Martha's, or Mary's and Martha's together. Thus, $12 = 3 \text{ times Martha's}$; Martha's = $12 \div 3 = 4$ quarts, and Mary's = $2 \times 4 = 8$ quarts.

102. Two men are $37\frac{1}{2}$ miles apart, and travel toward each other. When they meet, one has traveled $5\frac{1}{2}$ miles more than the other. How far has each traveled?

103. There were 21 books on two shelves of a book-case, 5 more on the first shelf than on the second ; 3 books were taken from the first and placed on the second shelf. How many were then on each shelf ?

104. A farmer had 47 sheep in two fields ; in one field there were 5 more than twice as many as in the other. How many were there in each field ?

SOLUTION. — Since twice the smaller number plus the difference equals the larger number, the sum of the two equals 3 times the smaller number plus the difference. Thus, $47 = 3$ times the smaller number $+ 5$; hence $42 = 3$ times the smaller number ; $42 \div 3 = 14$, the smaller number ; 2×14 plus $5 = 33$, the larger number.

105. There are 54 bushels of corn in two bins ; in one bin there are 12 bushels more than twice as many as there are in the other. How many bushels are there in each ?

106. A man bought a watch and chain for \$96 ; the watch cost \$4 less than 3 times the cost of the chain. What was the cost of each ?

107. John and Henry worked on a farm 11 days ; John received 20 cents a day more than Henry, and at the end of the time, together they received \$25.30. How much did each receive altogether, and how much per day ?

108. The sum of two numbers is 10 ; their difference is equal to $\frac{1}{3}$ of the greater number. What are the numbers ?

SOLUTION. — Since the greater number $= \frac{4}{3}$ of itself, and the difference $\frac{1}{3}$, the smaller number must be $\frac{2}{3}$ the greater. Dividing 10 into two parts, one of which is $\frac{2}{3}$ of the other, we have $\frac{2}{3}$ of 10 = 4, the smaller number, and $\frac{4}{3}$ of 10 = 6, the greater number.

109. The sum of A's and B's ages is 60 years ; 6 years ago, A's age was $\frac{1}{3}$ of B's. What are their ages now ?

110. A horse and cow cost \$124 ; the horse cost \$4

more than 3 times the cost of the cow. What was the cost of each?

SOLUTION. — $\$124 - \4 or $\$120$ is 3 times the cost of the horse, plus the cost of the horse, or 4 times the cost of the horse. Therefore the cost of the horse is $\$120 \div 4 = \30 , and of the cow $\$124 - \$30 = \$94$.

111. A grocer paid \$12.60 for 30 bushels of potatoes, giving 50 cents a bushel for good ones, and 20 cents a bushel for poor ones. How many bushels were good?

SOLUTION. — If all had been good, he would have paid \$15 or \$2.40 more than he did; each bushel of poor ones made a difference of 30 cents; hence there were as many bushels of poor ones as 30 cents (the difference on 1 bushel) is contained times in \$2.40 (the difference on all), which is 8 times; there were 8 bushels of poor ones. The difference between 30 bushels and 8 bushels is 22 bushels, the number of good ones.

112. A farmer bought 28 sheep for \$76, paying \$3 for old sheep, and \$2 for yearlings. How many old sheep did he buy?

113. Henry sold his watch for \$18, and by so doing lost $\frac{2}{3}$ of its cost. How much did it cost?

114. A flour merchant paid \$82 for 20 barrels of flour, giving \$4.50 for first quality, and \$3.50 for second quality. How many barrels were first quality?

115. A farmer's wife sold an equal number of chickens and turkeys for \$4, receiving for chickens 30 cents each, and for turkeys 50 cents each. How many fowls did she sell?

116. A grocer bought an equal quantity of wheat and beans, paying \$1.50 per bushel for wheat, and \$1 for beans; the wheat cost \$7 more than the beans. How many bushels of beans did he buy?

117. In a store employing an equal number of girls and boys, each girl received 50 cents, and each boy 70 cents a day; at the end of the day the cashier paid them

altogether \$7.20. How many girls and how many boys were there?

118. A man engaged to work 25 days, on condition that he should receive \$2 for every day's labor, and pay \$1 for board every day he was idle; he received at settlement \$38. How many days was he idle?

SOLUTION. — As many days as \$3 (the difference made by 1 idle day) is contained times in \$12 (the difference made by all the idle days), which is 4 times. He was idle 4 days.

119. A man was engaged for 20 days to copy law papers, receiving \$2.50 for every day's labor, and forfeiting \$1 for every day he was idle; he received \$43. How many days did he work?

120. A florist sold $\frac{2}{3}$ of all his carnations to a customer, who after losing 6 gave $\frac{1}{4}$ of what remained to her friend, and the 5 that still were left to a child. How many carnations had the florist?

SOLUTION. — The 5 given to the child = $\frac{1}{4}$ of what remained (since $\frac{3}{4}$ had been given to the friend). Therefore 20 remained after the customer had lost 6; $20 + 6 = 26$ the customer bought; if 26 was $\frac{2}{3}$ of all the florist's carnations, he had $\frac{1}{3}$ of $5 \times 26 = 65$.

121. Mary gave $\frac{3}{4}$ of her flowers to her playmates, $\frac{1}{4}$ of the remainder to her teacher, and had 2 left. How many had she at first?

122. A farmer sold $\frac{4}{5}$ of $1\frac{1}{2}$ times his flock, and had 12 sheep remaining. How many sheep had he at first?

123. A rope 28 feet in length was broken so that $\frac{2}{3}$ of the longer piece was equal to the shorter. What was the length of each piece?

SOLUTION. — The longer piece is divided into 5 equal parts, 2 of which equal the shorter; the sum of the 2 pieces is 7 of these equal parts, one of which equals $\frac{1}{7}$ of 28 feet, or 4 feet; 2 parts = 2×4 feet, or 8 feet, the shorter piece; 5 parts = 5×4 feet, or 20 feet, the longer piece.

124. A tree 56 feet high was broken in a storm; $\frac{3}{4}$ of the part standing was equal to the part broken off. What was the length of each part?

125. In a case containing 45 needles there are $\frac{4}{5}$ as many darning needles as there are embroidery needles. How many of each kind are there?

126. In a drawer there were 22 spools of cotton, some white and some black; $\frac{3}{5}$ of twice the number of white spools equaled the number of black spools. How many of each were there?

127. A grocer, having opened a barrel containing 160 pounds of sugar, took out $\frac{3}{4}$ as much as he left. How many pounds were left in the barrel?

128. A traveler paid 63 cents for his supper and lodging, paying $\frac{4}{5}$ as much for his supper as for his lodging. How much did he pay for his supper?

129. A horse and wagon cost \$170; the horse cost $1\frac{1}{2}$ times as much as the wagon. What was the cost of each?

130. Henry traveled 140 miles in 2 days; the first day he traveled $1\frac{1}{2}$ times as far as he did the second. How far did he travel each day?

131. David caught a trout 17 inches long; the tail was $\frac{2}{3}$ as long as the body, and the head was 3 inches long. How long was the tail?

132. Divide 36 into 2 such parts that $1\frac{1}{2}$ times one shall equal the other.

133. John has 15 oranges and lemons; $\frac{1}{2}$ of the oranges equals $\frac{1}{3}$ of the lemons. How many of each has he?

SOLUTION. — Since $\frac{1}{2}$ of the oranges = $\frac{1}{3}$ of the lemons, $\frac{3}{2}$, or all the oranges, = $\frac{2}{3}$ of the lemons; we must then have the oranges and lemons divided into 5 equal parts, 2 parts of which equal the oranges, and 3 the lemons; $\frac{2}{5}$ of 15 = 6 oranges; $\frac{3}{5}$ of 15 = 9 lemons.

134. A father gave his 2 sons 50 cents; $\frac{1}{2}$ of George's money was equal to $\frac{3}{4}$ of Henry's. How many cents had each?

135. Henry played at marbles with Charles, who had 45; Henry won as many as he had to commence with; when they quit, each had the same number. How many had both?

SOLUTION. — Since Henry won as many as he had, he left off playing with twice as many as he began with; and Charles, now having the same number, must have had 3 times as many as Henry when they commenced playing; $45 \div 3 = 15$, the number Henry had at first; and $45 + 15 = 60$.

136. A farmer having 60 sheep in one field, took as many from them as he had in another field, and put them with the others; the flocks were then equal. How many sheep had he?

137. Two boys are running in the same direction; one is 27 rods in advance of the other in pursuit, who gains upon the foremost 3 rods in a minute. In how many minutes will he be overtaken?

SOLUTION. — In as many minutes as 3, the number of rods gained in one minute, is contained times in 27, the number of rods to be gained. Therefore he will be overtaken in 9 minutes.

138. A, after traveling 2 hours, at the rate of 5 miles an hour, was followed by B, at the rate of 7 miles an hour. In how many hours would B overtake A?

139. A dog in pursuit of a hare which has 28 rods the start, runs 9 rods while the hare runs 7. How far must the dog run to catch the hare?

140. Henry saves \$5 while John saves \$7. How much will each have when the difference between what they have saved is \$30?

141. A wolf ran 80 rods to catch a sheep; $\frac{3}{4}$ of the distance the sheep ran was equal to the distance be-

tween them when the chase commenced. What was the distance ?

SOLUTION.—80 rods — the distance between them = the distance the sheep ran; $\frac{2}{3}$ of this, or 48 rods — $\frac{2}{3}$ the distance between them = $\frac{2}{3}$ the distance the sheep ran. Therefore 48 rods = $\frac{2}{3}$ the distance between them; $\frac{3}{2}$ the distance = 6 rods, and $\frac{3}{2}$ or the whole distance = 30 rods.

142. A and B started from the same point to run a race; A ran 84 rods and gave out, when $\frac{1}{3}$ of the distance B had run equaled the distance he was ahead of A. How far did B run ?

143. The hour and minute hands of a watch are together at 12 o'clock. When will they next be together ?

SOLUTION.—Since the minute hand passes the hour hand 11 times in 12 hours, if both are at 12, the minute hand will pass the hour hand the first time in $\frac{1}{11}$ of 12 hours, or in $1\frac{1}{11}$ hours, equal to $5\frac{5}{11}$ minutes past 1 o'clock.

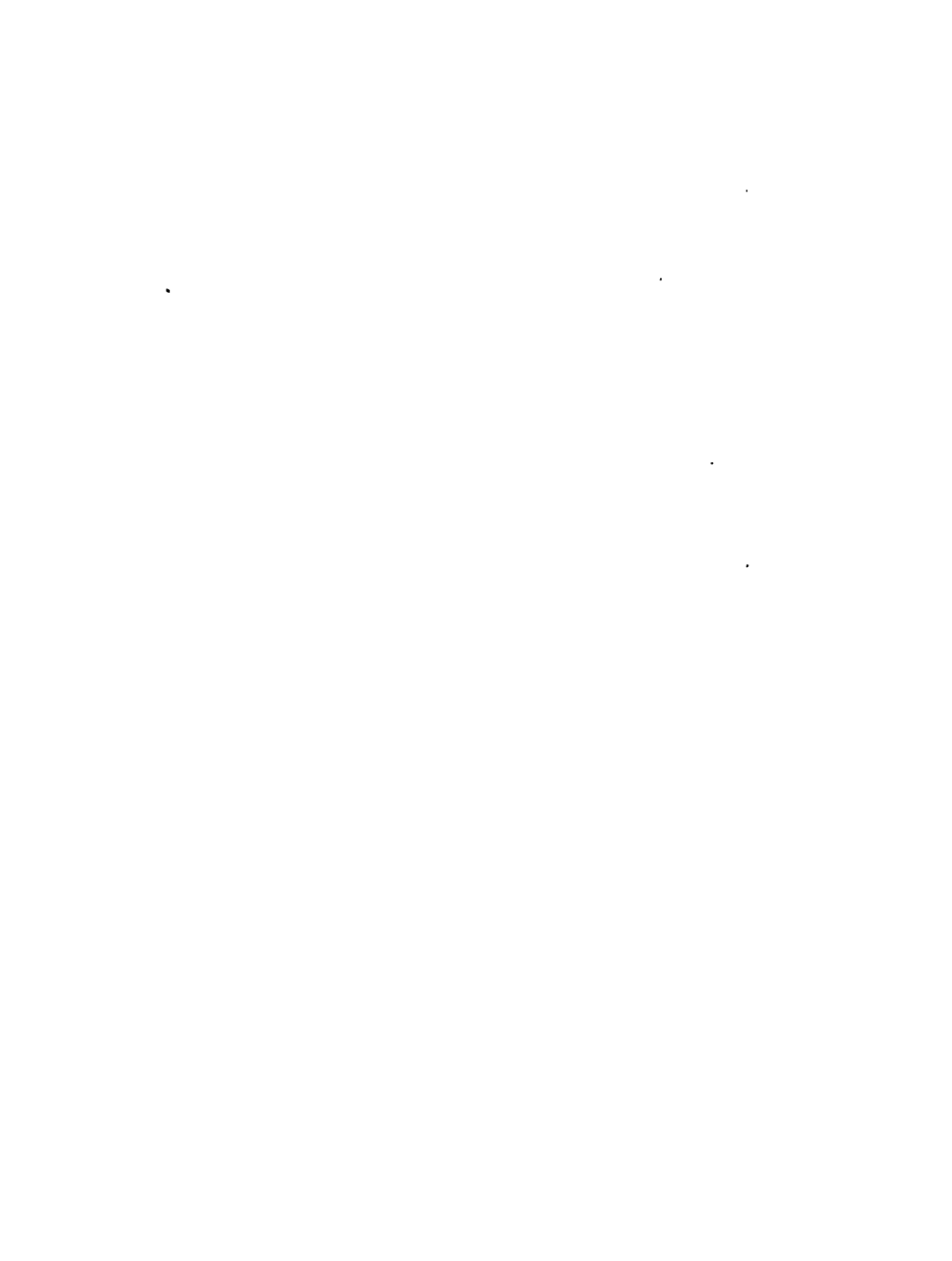
144. A fox is 40 leaps ahead of a hound, and takes 7 leaps to the hound's 4; but 3 of the hound's leaps equal 6 of the fox's. How many leaps will the fox take before being caught ?

SOLUTION.—If 3 of the hound's leaps = 6 of the fox's, 1 of the hound's = 2 of the fox's, and 4 of the hound's = 8 of the foxes. Since the fox makes 7 leaps to the hound's 4, the hound gains 1 fox's leap in every 4 leaps the hound takes, and it will take him $4 \times 40 = 160$ leaps to overtake the fox. 160 hound's leaps = $160 \times 2 = 320$ fox's leaps.

145. A hare has 70 leaps the start of a hound, and takes 5 leaps while the hound takes 3; but 8 of the hare's leaps equal 4 of the hound's. How many leaps must the hound take to catch the hare ?

146. A fox is 60 leaps ahead of a hound, and takes 4 leaps while the hound takes 3, but 1 of the hound's leaps equals 2 of the fox's. How many leaps must the hound take to catch the fox ?





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